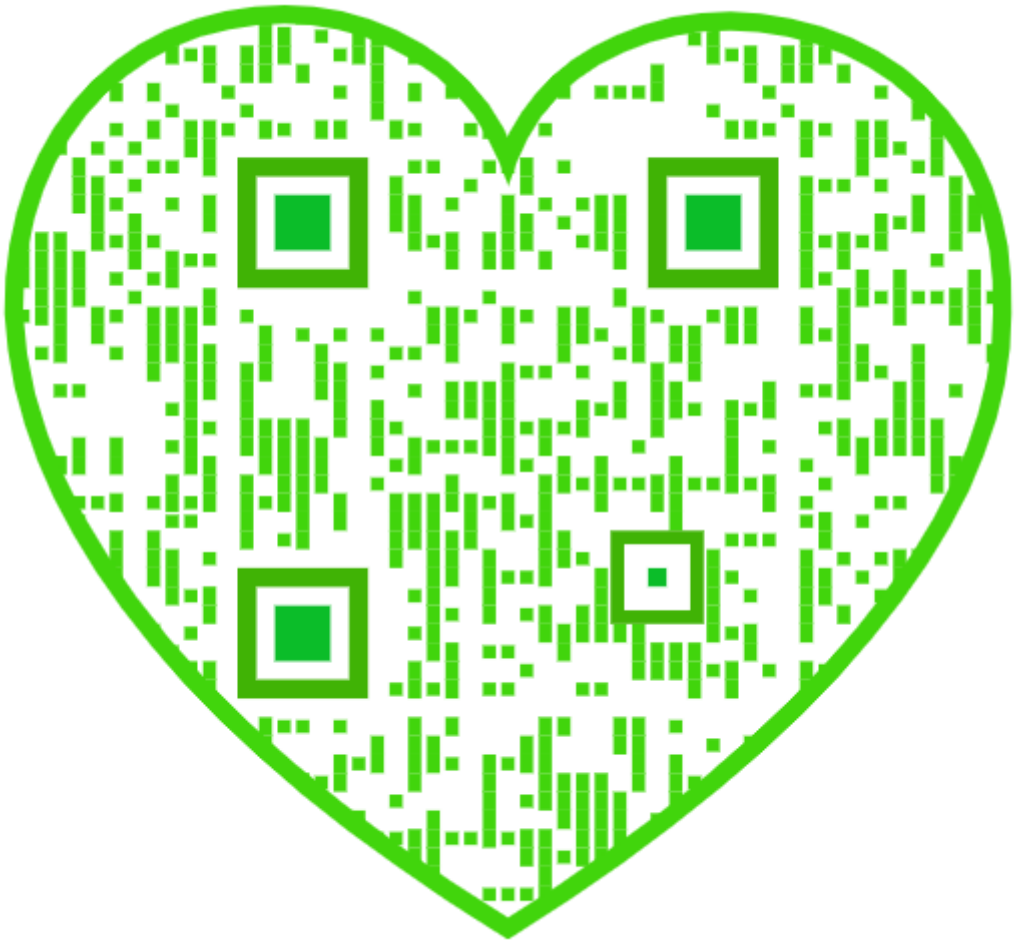

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ETHERIZATION;

WITH

SURGICAL REMARKS.

BY

JOHN C. WARREN, M. D.

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subject, the difficulties of such an undertaking, it has seemed to me, could not readily be overcome, especially that arising from the succession of new facts afforded by daily experience. Another year of observation will, it is to be expected, produce the materials for a more systematic and comprehensive history of etherization.

A controversy has arisen as to the claim of priority in the introduction of ethereal inhalation. It is not my intention to enter into any investigation on this point, as it will perhaps be hereafter examined, and settled by some competent tribunal.

ARVARD,

To

WILLIAM APPLETON, Esq., President;

Theodore Lyman, Esq., *Vice President;*

Henry Andrews, Esq., *Treasurer;*

Marcus Morton, Jr., Esq., *Secretary:*

AND TO

CHARLES AMORY,
NATHANIEL J. BOWDITCH,
ROBERT HOOPER,
FRANCIS C. LOWELL,
HENRY B. ROGERS,
J. WILEY EDMANDS,
WILLIAM T. ANDREWS,
GEORGE M. DEXTER,
THOMAS LAMB,
JOHN A. LOWELL,
J. THOMAS STEVENSON,
EDWARD WIGGLESWORTH, Esqs.,

Trustees of the Massachusetts General Hospital:

These pages are inscribed by the Author, as a respectful recognition of their interest in the introduction of Etherization into the Hospital, and also of their benevolent and judicious labors for enlarging the benefits of that noble Institution.

A YEAR having elapsed since the introduction of ether into surgical practice, the period of enthusiasm has passed over, the trials of its influence have been innumerable, and the time has arrived for a dispassionate judgement of its value. These considerations might seem sufficient to have brought out the labors of some of the able and judicious persons, situated in the birthplace of etherization, who have had opportunity of experience in the ethereal practice. But, although many valuable productions on this subject have appeared, none, I believe, have brought forward the fruits of our matured observation.

The utility of a new publication has therefore been evident for some time. But this would not have been of sufficient weight to have induced me to undertake it, had not a direct application been made, and had I not been frequently called to notice the slow progress of the practice of etherization in this country beyond the vicinity of its first introduction, compared with its rapid extension on the other side of the Atlantic.

The opportunity also of presenting some useful surgical observations, of a practical nature, in connection with the results of etherization, contributed to decide me to give my experience of the effects of ether in preventing pain, incorporating such surgical remarks as naturally presented themselves. These are therefore not interpolations, but a part of the plan previously laid out.

As a preliminary to these remarks, a large number of cases was collected for the purpose of publishing the names, diseases, and phenomena in each individual. This could with propriety include only the names of hospital patients, and would give but partial and unsatisfactory results. The etherizations on which these remarks are founded, amounting to at least two hundred, have been done in the presence of gentlemen, qualified to judge of the accuracy of the particular and general statements, and therefore seemed to render the publication of individual names unnecessary. The introduction of the minute details of particular cases, involving the repetition of appearances already well known to the public has also its objections. But we have thought it necessary to present a number of such cases, sufficient to display the effects of etherization in various operations and diseases. For it seems impossible to exhibit in their proper light the effects of the new practice without the aid of particular historical details.

Desirable as it would be to form a complete treatise on this

ETHERIZATION:

WITH

SURGICAL REMARKS.

ETHERIZATION, ETC.

I.

What surgeon is there, who has not felt, while witnessing the distress of long painful operations, a sinking of the heart, to which no habit could render him insensible! What surgeon has not at these times been inspired with a wish, to find some means of lessening the sufferings he was obliged to inflict!

Such feelings have often operated on my own mind, and led to various trials with many different agents, with opium in all its forms, and other narcotics, even in such quantities as really alarmed me, without any satisfactory result. Mesmerism, and its mimic, neurologism, were offered by their advocates for this purpose, but never having the slightest faith in their physical influence, their use could be admitted only as a possible means of producing insensibility to pain by acting on the mind of the patient; and although such a state of mind can be sometimes produced, yet unhappily it never was in cases under my inspection.

The discovery in these days of a property capable of so modifying the condition of the sentient organs, as

without injury to prevent the suffering produced by the division and laceration of the living textures, however desirable, was certainly unexpected. When such a property was found to exist in a well known substance, our surprise was increased, and we wondered at our own dulness in not having made the discovery before.

The general properties of ether have been known for more than a century, and the effect of its inhalation in producing exhilaration and insensibility has been understood for many years, not only by the scientific, but by young men in colleges, and schools, and in the shop of the apotheeary, who have frequently employed it for these purposes.

The ethers diluted with water may be and have been administered by the mouth. They have the exciting and composing effects of inhalation, but the eontact with the coats of the stomach of any large quantity of ether produces an excitement too great to justify its employment for the purpose of composing in a decided and speedy manner.

Many years have elapsed since I myself used ethereal inhalation to relieve the distress attending the last stage of pulmonary inflammation. So long ago as the year 1805, it was applied for this purpose, in the case of a gentleman of distinction in the city,* very frequently since, and particularly in the year 1812, to a member of my family, who experieneed from it great relief, and still lives, to give testimony to its effeets. The manner

* Thomas Davis, Esq., formerly Treasurer of this Commonwealth, who died in January, 1805.

in which it was applied was by moistening a handkerchief and placing it near the face of the patient.

A new era has opened to the operating surgeon! His visitations on the most delicate parts are performed, not only without the agonizing screams he has been accustomed to hear, but sometimes with a state of perfect insensibility, and occasionally even with the expression of pleasure on the part of the patient. Who could have imagined that drawing the knife over the delicate skin of the face might produce a sensation of unmixed delight! that the turning and twisting of instruments in the most sensitive bladder might be accompanied by a beautiful dream! that the contorting of anchylosed joints should co-exist with a celestial vision! If Ambrose Paré, and Louis, and Dessault, and Cheshelden, and Hunter, and Cooper, could see what our eyes daily witness, how would they long to come among us, and perform their exploits once more! And with what fresh vigor does the living surgeon, who is ready to resign the scalpel, grasp it, and wish again to go through his career under the new auspices!

During the year which has passed since ethereal inhalation was first employed in surgical operations, an immense number of trials of its influence have been made in various parts of the world, with a success perhaps as uniform as that of any article employed in medicine or surgery, and, what is more important, with as few ill consequences. Originating in this country, and in this city, its application was immediately transferred to Europe, and hailed with delight by nearly all the eminent surgeons and physicians in England, France,

Germany, and other countries. It has been employed in all kinds of operations, in a vast number of diseases, and although its effects have often appeared alarming, no satisfactory instance of fatal consequences has as yet been demonstrated. In estimating the danger we must also take into view the fact, that since the fear of pain has diminished the number of surgical operations has remarkably increased, at least in our vicinity.

The first proposal to me for the employment of ether by inhalation, for the prevention of pain in surgical operations, was made by Dr. W. T. G. Morton, about the middle of October, 1846. Calling on me, he stated that he had possession of a means of accomplishing this object, that he had made trials of its efficacy in the extraction of teeth, and that he wished me to test its power in surgical operations. The article used for this purpose not being mentioned, I supposed it was not proper for me to demand what it was, but I did think it necessary, before taking the responsibility of using it, or sanctioning its use, to ascertain whether a trial could be made without any apprehension of danger. Having satisfied myself on this point by various questions, I agreed to give Dr. M. the desired opportunity, as soon as it should be in my power. No such opportunity having occurred within a day or two in private practice, and being at that time in the performance of my tour of duty as attending surgeon at the Massachusetts General Hospital, I seized the occasion of the first operation in that institution for the proposed experiment.

The patient was a young man, about twenty years old, having a tumour on the left side of the neck, lying par-

allel to, and just below the left portion of the lower jaw. This tumour, which had probably existed from his birth, seemed to be composed of tortuous, indurated veins, extending from the surface quite deeply under the tongue. My plan was to expose these veins by dissection sufficiently to enable me to pass a ligature around them.

The patient was arranged for the operation in a sitting posture, and every thing made ready; but Dr. Morton did not appear, until the lapse of nearly half an hour. I was about to proceed, when he entered hastily, excused the delay, which had been occasioned by his modifying the apparatus for the administration. The patient was then made to inhale a fluid from a tube connected with a glass globe. After four or five minutes he appeared to be asleep, and was thought by Dr. Morton to be in a condition for the operation. I made an incision between two and three inches long, in the direction of the tumour, and to my great surprise without any starting, crying out, or other indication of pain. The fascia was then divided, the patient still appearing wholly insensible. Then followed the insulation of the veins, during which he began to move his limbs, cry out, and utter extraordinary expressions. These phenomena led to a doubt of the success of the application, and in truth I was not satisfied myself, until I had, soon after the operation, and on various other occasions, asked the question, whether he suffered pain. To this he always replied in the negative; adding, however, that he knew of the operation, and comparing the stroke of the knife to that of a blunt instrument passed roughly across his

neck. Now that the effects of inhalation are better understood, this is placed in the class of cases of imperfect etherization.

On the following day, an operation for the extirpation of a tumour from the arm was performed by Dr. Hayward, during which the patient exhibited no sign of physical or intellectual suffering.

A few days after these first operations I was informed by Dr. C. T. Jackson, a gentleman well known for his chemical and philosophical attainments, in a conversation which took place between him, Dr. Augustus Gould, (the naturalist,) and myself,—that he first communicated to Dr. Morton the inspiration of ether, as a means of preventing the pain of operations on the teeth. This I have already stated in the account of the first six cases of ethereal inhalation, written at the request of a gentleman who took great interest in the introduction of ether, R. H. Eddy, Esq., and published in the Boston Medical and Surgical Journal of December 19, 1846.

Anxious to extend the benefits of the inhalation to as many patients as possible, believing a peculiar apparatus necessary, and having the use of none excepting that in the hands of Dr. Morton, I requested Dr. Charles Heywood, the house-surgeon of the Hospital, who took an early and active interest in this matter, to procure a glass globe, and add to it the tube necessary for its application. At this period, however, I was checked by the information, that an exclusive patent had been taken out, and that no application could be made without the permission of the proprietor. The knowledge

of this patent decided me not to use, nor encourage the use of the inhalation, until a more liberal arrangement could be made. Dr. Hayward concurred with me, and having procured from Dr. Morton a letter of explanation to the surgeons of the Hospital, which was judged satisfactory, we felt ourselves justified in prosecuting the practice without restriction.

From this time the use of ether was adopted in the operations at the Hospital by the various surgeons of the institution, Drs. Hayward, Townsend, J. Mason Warren, Parkman, and H. J. Bigelow, as well as by myself, with uniform success, so far as its great object, the existence, or at least the recollection of pain was concerned, but with symptoms varying in degree from total insensibility to a knowledge of surrounding objects and passing events. I may also add with pleasure, that the physicians of the Hospital, Drs. Bigelow, Hale, J. B. S. Jackson, Bowditch, Holmes, and Fisher, gave their early attention to the subject, and uniformly and unanimously concurred in opinion with the surgical department. Among other physicians of this place, who took an early and decided interest in this subject, I shall only mention Dr. James Jackson, late Professor of the Theory and Practice of Medicine, and Dr. A. L. Peirson, of Salem. In private practice successful applications were immediately made in the presence of physicians, surgeons, and others, affording them the same satisfaction which we had experienced.

Accounts of these wonderful performances were at once transmitted to Europe, by Drs. Ware, C. T. Jackson, H. J. Bigelow, Morton and myself.

From that period to the present I have operated, and assisted in operations where ether was employed, in about two hundred cases, and have directed its use in a number of patients under my care where I was not present. To the information obtained from these operations I have the advantage of adding a large number performed by my son, Dr. J. Mason Warren, the details of which were furnished me as they occurred.

II.

The appearances presented by the patients under the influence of ether have a general resemblance: they are varied, however, by the constitution of the patient and the mode of application, so as to present exceptions, to an extent it would be useless to describe.

The first inhalations were made through the tube and glass globe of Dr. Morton, afterwards a sponge, as applied by Dr. Mason Warren in the cases of children, was used also in those of adults, found to be more safe and convenient than the tube, and therefore employed in the greater part of our practice.*

The first symptom usually noticed is a short cough, which impels the patient to remove the sponge; but being urged to allow it to be replaced, he readily consents, perhaps after a slight expectoration, and no severe pulmonary irritation being felt, he proceeds to inspire the va-

* Dr. Mason Warren first used the sponge for children in February, 1847—[see Boston Medical and Surgical Journal for March.] At about the same time it was used by Dr. Smith, a distinguished physician of Cheltenham, England, but does not seem to have been extensively employed by him till the latter part of March, or first of April.

porous draught more and more deeply, until he becomes insensible. The respiration is then often audible, and sometimes even apoplectic; afterwards feeble and almost imperceptible — a state, which, however accustomed to it, excites a degree of uneasiness on the part of the surgeon, and leads him to investigate more carefully the condition of the pulse. My own practice has been, when not doing the operation myself, to keep the fingers applied to the patient's pulse during the whole process of etherization. This, quickened from mental causes before the operation, is still more so a short time after inhalation, sometimes excessively; subsequently it becomes slower, feebler, and even scarcely perceptible. When this is found to be the fact, the sponge being removed, the pulse becomes more free; then, if necessary, being re-applied, the same phenomena may present themselves many times during a long operation. The pulsations of the heart are often hard and vibratory. The circulation in the capillaries, especially of the face, neck and upper part of the chest, is so much increased as to redden the skin, an appearance which rarely continues long, and gives place to paleness, succeeded by cold perspirations.

The gastric phenomena are less remarkable. There is a propensity to nausea in a number of cases, which not unfrequently amounts to vomiting, sometimes protracted to the following day. Relaxation of the vesical or intestinal sphincters does not ordinarily occur, but it is certain that in strictures an instrument may be more readily passed through the œsophageal and urethral canals in a state of etherization.

In a female patient affected for many days with an

absolute retention of urine, etherization was followed by a free exeretion, and the retention never returned. Whether in this case the relief was obtained by relaxation of the vesieal sphineter, or by tonie etherization of the vesieal parietes, it really is not possible to say.

The museular apparatus is exeited at an early period. The fists may be clenehed, the museles of the upper extremities and neek eontraeted, sometimes eataleptieally; more eommonly they perform various movements, as if the patient were trying to extrieate himself from his new situation. Such movements are less frequently seen in the lower extremities.

The eonjunctiva of the eye is often injeeted with blood; the pupils generally eontracted, sometimes dilated in a powerful etherization, frequently fixed. The eyelids are oeeasionally strained open, more frequently elosed; and when elosed, the patient, if still eonscious, being ealled on to open them, has the power of doing so, thus affording a test, which, though by no means universal, in some degree enables the operator to determine whether the operation shall begin.

The most eurious of the ehanges produeed by etherization are those of the sensitive and intelleetual funetions; these ehanges, however, are exeeedingly various in their form and order, but they usually terminate in a suspension of both sense and intelligenee. In a number of instanees tactile sensation, the sense of feeling, appears to be suspended, (as the patient has no reeolleetion of suffering,) while the intelleet exists. The organ of intelleet seems eapable of taking eognizanee of objeets external, while it either does not

notice the impressions on the feeling nerves, or if it does they do not produce on it the usual effects.

These appearances, at first so astounding and unintelligible, seem to support the doctrine so satisfactorily explained by Dr. Carpenter, in the British and Foreign Review, No. XLIV, and in return are illustrated and explained by this doctrine, viz. that the seat of tactile sensibility is in the great cephalic ganglia, while the intellectual functions reside in the cerebral lobes. If these lobes were, as formerly believed, the *sensorium commune*, or common centre of all impressions, as well as of intellectual functions, then it would be difficult to understand how common feeling, or tactile sensitiveness could be suspended, while intellect, and even visual and auditory sensibility continued. But if tactile sensitiveness reside in the thalami, corpora striata, or annular protuberance, it is possible it may be suspended without suspension of the action of the cerebral lobes. So visual sensation, residing in the tubercula quadrigemina, may be, as we know it often is, intermitted without intermission of intellect; and the same may be said of the auditory function.* Hence arises a question not so satisfactorily answered, — why in some cases etherization should affect the seat of common feeling, i.e. the ganglia, without in the same degree affecting the cerebral mass? for these ganglia are not so situated, as to come under the ethereal influence through the circulation earlier than other parts of the encephalon. And if we admit that the influence is introduced through the

* Vide Appendix B.

nerves, then the par vagum, or pneumogastric nerves originating from the medulla oblongata would, we should expect, influence this part primarily, which thus being obnoxious to the first attacks of ether would experience an interruption of its function, and reacting on the lungs produce a suspension of respiration. This, we know, does sometimes happen, but generally in an advanced stage of etherization, and after the interruption of functions depending on other parts of the encephalic mass.

Flourens, Longet, and other French physiologists, as appears by reports and discussions before the Royal Academy of Medicine in Paris, in March and April of the present year, and which are reported in the Paris Medical Gazette of Dr. J. Guérin,* have been able by experiments on animals to satisfy themselves what parts of the brain are first etherized, and in what order the others follow. The course of my experience in human etherization is in favor of the opinion expressed by Professors Roux and Velpeau, that the symptoms are not so distinct, nor so regular, as to enable us to determine with precision which division of the nervous system will be first affected, and in what order the others.

To illustrate the fact, that tactile sensation may be suspended without suspension of intellect, two or three cases may be mentioned, which are, of course, to be considered as not exhibiting the most perfect phenomena. In the month of April, 1847, a medical gentleman

* This journal was one of the earliest and most judicious supporters of the claims of etherization to public attention.

brought his wife to Boston from a great distance, for the removal of a scirrhous tumour under the influence of ether. The apprehension of pain had led her to object to the operation, until she became acquainted with the power of ether. She was thirty-five years of age, a lady of education, and what is usually called a nervous person. Being placed in the upright posture inhalation was applied by the sponge. At first it caused some pulmonary irritation; she was soon after able to inhale freely, and showed marks of physical and mental excitement. She talked wildly, cried, and sank down in her chair: she thought she was in the cars, and complained of the motion. The sponge was employed for fifteen minutes without signs of loss of intellect. Apprehensive of the effect of too long a use of ether, I determined to begin the operation.

To the incisions in the skin she exhibited no marks of sensitiveness, soon after cried out, and made considerable movements, which continued through the operation. Her husband, an intelligent physician, pained and disappointed by her apparent suffering, considered etherization to be a failure. After all was concluded she expressed delight, that she had been relieved of her disease without pain; and during the cure repeatedly made use of the same expressions, exhibiting an unusual cheerfulness caused by her escape from suffering.

This lady could see, hear, answer questions, and understand the directions and persuasions addressed to her; yet she uniformly said, that the operation had given her no pain. It has been suggested, that in such cases the pain is not recollected; but the supposition that

one intellectual, i. e. cerebral, faculty is suspended, while the others continue, is more difficult than that of the suspension of the feeling-faculty independently of the intellectual.

Soon after the above operation, a gentleman who resided at a great distance, came to Boston for the purpose of having a tumour removed. He informed me, that although usually in the enjoyment of good health, he was of a nervous temperament, and readily agitated by moral and physical impressions. Preparatory to the operation he was placed on a bed. The head being raised, a sponge was applied to the nostrils, and the mouth closed; as it has appeared, that less cough is produced when the inhalation is through the nostrils. For five minutes he showed no external sign of etherization; then said, "now it is beginning,"—"I feel it in the chest,"—"now I feel it in the legs." Presently he began to speak rapidly, rose from the bed, and with many gesticulations uttered a harangue, partly on politics, partly on the medical profession, to which he was highly complimentary, but principally on the blessings which would flow to humanity from the discovery of etherization. This state was so gratifying, that with difficulty was he prevailed on to resume his place on the bed, and to reapply the sponge. In a few minutes more he closed his eyes, and believing him asleep, the operation was begun. He immediately spoke, encouraged its prosecution, and in two or three minutes it was concluded. Thereupon he again broke forth in a highly poetical strain, described the delight he had experienced from the passage of the knife through the skin, the

gratification he felt at the different steps of the operation, and its happy conclusion.

The symptoms of etherization continuing, I remained with him half an hour, during which he exhibited a variety of emotions, mostly of a pleasurable character, but terminating in a hysterical affection with a free discharge of tears. From time to time muscular tremors pervaded his whole system, especially the lower extremities, without movements of the limbs. His wound, two or three inches in length, was perfectly united on the third day, and on the fourth he left Boston.

In the latter part of May, 1847, another instance occurred, in which the intellectual faculties were awake through the whole operation, together with movements so strongly indicative of pain, that two very intelligent physicians present were satisfied the ether had been of no use, till after the operation, and at subsequent periods, they had an opportunity of questioning the patient themselves, with the uniform reply, that she had experienced no suffering. The disease was a tumour in the right breast, which, although it was only of five weeks' continuance, had attained the size of a lemon, and was rapidly increasing. It proved to be a dark-colored, vascular growth, of soft consistence, having the appearance of malignity, with the exception that its circumference was quite regular and separated from the glandular texture in which it was buried, by a distinct, though very thin sac.

This lady was forty-five years old, married, quite fleshy, but not remarkably healthy, and very excitable, or nervous, of course dreading the operation, and glad

to resort to the use of ether. The horizontal posture was employed, and the sponge applied to the nostrils; in a few minutes her limbs became agitated, she talked a great deal, and displaced the sponge. More than a quarter of an hour elapsed before she became sufficiently tranquil to begin the operation; and it would have been delayed longer, for the purpose of increasing the etherization, but that some apprehensions existed of its consequences in such a constitution. Similar apprehensions have frequently had a similar influence, until a more prolonged experience proved them to be groundless. The first incisions of the knife, pretty extensive, caused no movement. As the dissection proceeded, there occurred motions of the body and limbs, wild cries, protestations on the part of the patient of her great resolution and ability to endure suffering, frequent appeals to her physician to bear testimony to the fortitude with which she had supported various diseases, and strange dreamy expressions of apprehension from an operation she was expecting to undergo. With difficulty the morbid mass was extirpated from its connection with the mammary texture, and the operation was undoubtedly more protracted than it usually is in patients not etherized. There was much bleeding, and a number of arteries were tied.

The principal symptoms of etherization disappeared in about half an hour. The following day she was tranquil and comfortable, with the exception of vomiting, which had continued from the time of the operation, and declared she had not suffered but from the ligature of the arteries. The unmanageable state of this patient

during etherization caused at the time a sentiment of regret at its use; but subsequently, when she expressed her great satisfaction at having escaped the dreaded pain, the ultimate conclusion was in favor of ether.

To these cases many similar might be added, but I will only mention one, which did not occur in my own practice. A friend of mine, a lady, had three teeth extracted under etherization. She was perfectly able to count them as they were removed, but was entirely without pain during the extraction of the first two. Of course the seat of intellect was not etherized, while that of pain was, during these two operations.

The phenomena of these cases support the opinion, that the seat of intellect and that of pain are different.

The intellectual phenomena, while the cerebral functions are in a state of activity, though exceedingly various, are principally of two kinds, — the gay, and the lachrymose. The former, most frequent in males; the latter in females; in both the most prominent trait of character is apt to be displayed and exaggerated. In general, it may be said, that in most cases of etherization, there is a gradual increase of the cerebral excitement, till somnolence suddenly appears; and on the return of intellect, this state, at first strongly marked, gradually fades into the ordinary condition of the mental faculties; but to this course there are many exceptions.

The young man, whether in a state of somnolence, or of excitement, has visions of rioting, travel, happy meetings with distant friends, and many enjoy the idea of the rapid motion of the rail-cars. A sea-captain made a voyage to Sumatra, and triumphantly repulsed a host

of Malays, who were assailing him with pikes and cutlasses. Combativeness, attended with oaths and imprecations, is sometimes developed in a degree troublesome and even alarming to those around. This disposition is frequently alternated with strong expressions of affection and gratitude.

The female exhibits hysterical phenomena. She has alternate fits of laughing and crying, though more disposed to the latter than the former; and if married, she has dreams of her distant husband, or absent children. A female, who had exhibited restlessness during an operation, said, she dreamed that her child affected with hooping cough, and having a paroxysm of strangling, seemed neglected by her husband, who was unwilling to raise and support it. Indelicacy in expression or action has never presented itself in the range of my experience.

The manifestations of passion are so numerous that it would be difficult to describe them all, but those enumerated will perhaps be sufficient to convey a notion of their character. Pleasurable sensations seem on the whole to predominate; and many patients, both male and female, are anxious to renew the gratification they have experienced.

III.

A question has arisen as to the channel through which ether passes into the system from the pulmonary organ; and specifically, whether it produces its effects through the medium of the nerves, or that of the blood vessels. In favor of the former opinion, is the rapidity with which it operates; and its analogy, in this particular, with the action of some poisons, supposed to exert their influence through the nervous system, as for example that of prussic acid applied to the mucous membrane of the tongue. If this influence is transmitted by the pulmonary nerves, the medulla oblongata through the par vagum would necessarily receive the first shock, as already suggested; its functions would be suspended, and life irrevocably extinguished. Should it be objected, that the medulla could not be so powerfully affected by a retrograde nervous action through the pneumogastric nerves, the hypothesis falls to the ground. The other pulmonary nerves can hardly be supposed to form a channel of communication to the exclusion of the pneumogastric. The opinion may

perhaps be tested by experiment, yet it must be confessed it is hard to conceive that any such experiment should be quite satisfactory.

The rapid introduction of ether through the vascular network spread in the pulmonary mucous membrane, is not difficult to understand. The immense surface formed by the pneumonic vesicles, the infinite number of capillaries spread through their parietes, the facility with which air and other fluids are imbibed by them, and the rapidity with which the blood, charged with these fluids, courses through the system, seem to afford a satisfactory answer to the proposed question. The principal difficulty appears to be in the last of these facts—the rapidity of the etherization compared with that of the circulation. We have rarely seen any important signs of etherization in a period short of two minutes. Now it is perfectly established by experiments mentioned by Muller, as having been performed by Mayer, (vide Muller's Physiology, vol. i. p. 239,) that on the introduction of a solution of the prussiate of potash into the lungs, the presence of this salt could be detected in the serum of the blood by the blue precipitate produced by the addition of the sulphate of iron, as early as from two to five minutes.

But laying aside this and all other experiments on animals, we are able to show the rapid course of the blood, by observations on the living human body many times repeated. In persons affected with chronic inflammation of the prostate gland and of the mucous coat of the urinary bladder connected with it, for example, the introduction of a glass of wine into an

empty stomach will, in particular subjects, and especially in those not accustomed to the use of wine, cause a painful irritation of these organs in less than three minutes. An observation of this fact in different persons, and of its frequent occurrence in the same person, allows no doubt as to its exactness.

The internal pulmonary is vastly greater than the internal gastric surface; the tenuity of the mucous membrane of the former, greater than that of the latter; and the disposition to imbibition much exceeding in the pulmonary that in the gastric surface. As ether received into the pulmonary blood, and sent to the left cavities of the heart, must be transmitted in a few seconds to the encephalic masses, there seems to be no difficulty in believing, that in two minutes a sufficient quantity might be received to produce its peculiar effects. On the whole then, the opinion, that etherization takes place through the blood vessels, is the most satisfactory.

IV.

No powerful medicinal substance is without its mischiefs. Opium, antimony, quicksilver, and other violent medicines, occasionally produce alarming and even fatal effects. That so active and volatile a fluid as ether, employed to produce a temporary abolition of the faculties of feeling and of intellect, should occasionally bring on dangerous symptoms, might naturally be expected. Perhaps the apprehensions arising from this cause have formerly checked the thought of employing it in the way of inhalation. And hence, no doubt, when etherization was first introduced, judicious persons were of opinion so many alarming symptoms would follow its introduction into the pulmonary organs, that they were led to prognosticate a short reign to ethereal practice; and we must confess, that a case of perfect etherization can rarely be witnessed, without a sentiment of uneasiness, and an anxiety to see the patient recover from his partial and temporary death.

The most remarkable ill effects we have noticed are of two kinds; first, those caused by the exclusion of the

oxygenous principle from the lungs; and second, those from excessive etherization of the nervous centres.

1st. The ill effects arising from the exclusion of oxygen occurred in the early part of the ethereal practice. Their occurrence led me to believe and to say to the medical class, that the interruption of the sensitive and intellectual faculties arose from asphyxia, — an opinion which has also been advanced and ably supported by one of the most distinguished physiologists of the present time, M. Flourens, and by others. The appearances which led to this opinion were, an increased labor, and sometimes even a suspension of respiration, a dark color of the skin, a purple flow of blood from divided arteries, an increased fluidity of the blood, a difficulty in suspending hæmorrhage, and a disposition to its recurrence. When to these were added the loss of sense, both nervous and cerebral, and a deathlike coldness of the body, we were led to consider as present the phenomena of asphyxia, and to view them as constituting a formidable objection to the new practice.

An accident of this kind occurred in an operation performed in November, 1846, for the removal of a tumour of the lower jaw in a female about forty years old. Etherization was effected rather slowly, and of course more ether was imbibed than in most cases; but insensibility at last appeared, and the operation began without exciting any marks of pain. Soon after the patient uttered some cries, her respiration became convulsive; a violent cough with symptoms of suffocation followed; the skin became livid and cold, the arterial

blood dark colored, the respiration and pulse imperceptible; and of course a strong apprehension was excited, that life might be extinct. Under the use of stimulants, frictions, and change of posture, the vital actions reappeared, and the operation was satisfactorily finished. The hæmorrhage was great, many arteries requiring ligature. In the course of that day, and even the following, there were fresh bleedings. Ultimately, the patient did well.

About the same time, very similar appearances presented themselves in a case of excision of a portion of the upper jaw.

Such instances as these occurred, however, only in the early history of etherization, when the valved tube was employed to limit the entrance of atmospheric air, and produce a more exclusive inhalation of ether. As soon as the valve was removed, and especially after the introduction of the sponge, asphyxia ceased to occur, so that, in upwards of a hundred consecutive cases, there has not been more than a single instance, and this of short duration. There are no longer to be seen those violent struggles for breath, purple hue of the blood, or difficulty in the suppression of hæmorrhage. Of course we can no longer entertain the doctrine, that the state of etherization is a state of asphyxia. In the opinion of some, asphyxia is occasionally brought on, not by the substitution of ether for air in the lungs, but by the exclusion of the latter, in consequence of closure of the glottis from spasm of the laryngeal muscles.

According to another doctrine, which has been advanced, and which seems to be a modification of that

of asphyxia, etherization produces its peculiar effect by a combination of asphyxia and intoxication. Ether, we know, at a high temperature having a strong affinity for oxygen, combines even with that of the atmosphere at the temperature of the lungs. According to the present theory, a part of the ether inhaled is capable of being decomposed by the pulmonary temperature; and being decomposed, or in other words burnt, combines with the oxygen which should unite with the blood, and thus prevents its due oxygenation. The consequence will be, the circulation of a semi-oxygenated blood, an imperfect hæmatosis, and a partial asphyxia. Another portion of ether is imbibed by the blood, and acting as a toxic principle, paralyzes the nervous system. However true the last part of this theory may be, the former will find a practical objection in the fact frequently noticed in these remarks, that the phenomena of asphyxia are absent, when etherization is accomplished by the sponge, or by any apparatus in which a sufficient quantity of atmospheric air is inhaled with the ether.

There is a strong resemblance between etherization and alcoholization. Without entering into the discussion of a question, which for the want of a sufficient number of facts cannot be satisfactorily answered, we will simply say, the effects of alcohol are more gradual in their production, more slow in their disappearance, operate more decidedly on the cerebrum, and less on the sensitive faculties.

2d. The principal known ill effect produced by excessive etherization of the nervous centres, is a state of

general convulsions, without signs of asphyxia. This is sometimes so violent, as apparently to threaten life; but by immediate suspension of the ether, and the free affusion of cold water, the convulsions cease, and do not recur. A young medical gentleman underwent an operation for a contraction of the hand, extended to about fifteen minutes. On the first inhalation, he had very agreeable visions, imagining he saw the twelve apostles, one of whom assured him, that the success of this operation would serve as an evidence of the truth of Christianity. This agreeable dream was interrupted by the strokes of the scalpel; intelligence was restored; he became very restless; demanded more ether, and this being administered, insensibility returned, followed by a convulsion threatening the extinction of vitality. But on the free application of cold water, the frightful agitations ceased, and permitted a satisfactory conclusion of the incisions.

In a case of operation for the removal of diseased bone, at the Massachusetts General Hospital, at which were present among others two distinguished surgeons of New York, Drs. Stevens and Parker, the patient not being very susceptible to the action of ether, the application was continued from ten to fifteen minutes, and his stomach being well charged with food, he had first a violent vomiting, and soon after a general convulsion. This lasted a very short time, did not recur, nor was it followed by any ill consequence. Perhaps, in this case, the patient was overdosed; and it might have been better in this, and may be in other similar cases, when the patient is unusually insensible to the

ethereal action, not to prolong the inhalation to a great extent. After all, the occurrence of convulsions is so very rare, that it must be considered an exception to a general fact, and to form no greater objection to etherization than the occasional overaction of many other articles of the Materia Medica.

On the same day, in the presence of the same gentlemen, an operation was performed for the removal of a fibrous tumour near the knee joint, under a perfect etherization, without suffering, and without unpleasant symptoms.

There are a few cases, in which ether renders the patient unmanageable; and although most of them may be successfully treated by prolonged etherization, yet, when the proposed operation is not very painful, it seems best to relinquish the inhalation. In October, 1847, a patient was to be operated on for the radical cure of an inguinal hernia. We did not wish to use ether, because the pain of the operation would be very slight; but as he strongly demanded it, the sponge was applied for ten minutes, without any satisfactory effect. The inhalation being still continued, he became uneasy, and finally so ungovernable, that the operation was postponed.

Other less important unfavorable symptoms might here be mentioned; but as these vary excessively, and are stated in the different cases, it will be unnecessary to recur to them in this place. No instance of death in man from inhaling ether has occurred in our knowledge, or belief. For although there have been a number of cases reported as fatal, yet in these the

connection between the cause and its supposed effect appears to be too imperfect to bear a close examination. Only one occurrence of this nature has happened here. A boy of very bad habits, whose arm was torn off by machinery, had an amputation at the shoulder-joint skillfully performed by Dr. Lewis on the day after the accident under etherization, and died in eight hours.

Is there any thing remarkable in the death of a boy, in the habit of using spirituous liquors freely, from a laceration of the arm near the shoulder, requiring an amputation at the joint? How many surgeons have had the pain of witnessing the failure of a patient from the shock of a severe surgical operation! Is it not wonderful, that among the hundreds of surgical operations performed in this city under etherization, only one has had a fatal termination? How many thousand have been executed in Europe within the ethereal period, and how few of the subsequent deaths have been imputed to this cause! A number of these imputed cases, so far as we have heard of them, may fairly be attributed to that terrible shock of the nervous system produced by a great surgical operation; a principal part of which shock is in many cases the effect of the pain, which the virtue of ether prevents; and the others to different causes independent of ether. Those who have serious doubts as to these cases, will find their apprehensions relieved by the distinguished Mr. Travers's work on Constitutional Irritation, and the able article on Etherization in the British and Foreign Medical Review for April, 1847.

We think it then fair to say, that the number of deaths from surgical operations after etherization, has not been greater than it would have been without. May it not be said even, that this number has been lessened by the exclusion of the shock from pain, which would have occurred, had it not been administered?

There are other ill effects, actual or supposed, which cannot in the present state of our knowledge be placed under either of the preceding heads. It has been said, that etherization breaks down, or dissolves the red globules, increases the fluidity of the blood, and diminishes its tendency to coagulate. Some of these consequences we have noticed as the result of asphyxia; but that they do not ordinarily follow etherization, is fully shown by the fact, that, with the exception of three or four cases out of at least two hundred, there has been no want of red globules, no tardiness in the coagulation, of course no tendency to excessive hæmorrhage, either primary, or secondary, no extraordinary fluidity of the blood, and no unusual delay in the healing process. An amputation of the thigh, detailed hereafter, with perfect etherization, performed by Dr. J. M. Warren in July, 1847, was followed by a union of nearly the whole surface by plastic lymph, a little suppuration occurring at the place of the ligatures only.

Among the other allegations against etherization, we have heard, that it may produce uterine hæmorrhage and abortion. No facts in support of these charges, of a satisfactory nature, have come within our knowledge; nor do we see reason to believe that there are any more grounds for them, than for those which might

be made against the use of a number of the most valuable remedies of the Materia Medica.

A more plausible objection is, that ether may be used too frequently; that it may be employed to produce a state of intoxication; that it may be and has been administered to infants for very slight causes. The same objection may be made to opium, hyoscíamus, the other narcotics, and to many other medicines. Ether has one advantage over many of these, that it cannot be introduced secretly, as its volatility diffuses it so widely that its presence is immediately detected. In regard to intoxication, it must be admitted, that it may be and has been employed for this purpose; but so far as is known, it has rarely been habitually used, and is not likely to be, because there is no adequate pleasure at the moment of its reception, and because the exhilaration is too brief and too violent to become an object of strong and general desire.

Another imputation against the practice, is its tendency to the production of chronic pulmonary affection. So vast is the number of instances, in which no pulmonary disease has followed, that it can hardly be necessary to combat the terrors of such an opinion; for, even if disturbance in the pulmonary organ did sometimes occur, it ought to be considered as an extraordinary occurrence. If any of the supposed mischiefs actually arise, they would, from the nature of the application, be of an acute, rather than of a chronic character, and we should at once discover the evil, and shape our practice accordingly. Our experience has known no other derangement, either chronic or acute, than tran-

sient soreness of the chest in some delicate females, and in a single instance a cough, attributed to the ether without any sufficient reason. On the other side, it may be said, that ethereal inhalation is the most powerful of known expectorants, and that it has, under our observation, proved very efficacious in chronic bronchitis and spasmodic asthma. Nysten, more than thirty years ago, in the Dict. des Scien. Med. vol. xiii. 1815, recommended "the inhalation of ether, as having been employed with advantageous effects in chronic catarrh, spasmodic asthma, and other diseases, respired for one or two minutes, and repeated five or six times in the day."

In speaking of the dangerous effects of inhaling ether, we have not alluded thus far to its employment by the dentist, because in his cases its application is usually more brief, and its introduction more limited. But as there must be, as has been shown, great differences in the dispositions to be affected, and of course many instances of a necessarily prolonged application, we might reasonably expect to hear of a certain number of fatal terminations, if this is really a sufficient cause for their production. Now, we know that in the practice of Dr. Morton and other dentists in this city, cases of etherization have amounted to some thousands. Has any one among us heard of a death from etherization after the extraction of a tooth? We also must recollect the hundreds of thousands which have occurred in the great countries of Europe, and if we look into the foreign journals for the records of mortality in these cases, what will be the result?

The Council of Zurich, for reasons we are not acquainted with, have prohibited the use of ether in the extraction of teeth. Probably, when they have had more experience of its innocuity, they will be disposed to repeal the prohibition, and allow their citizens the privilege of avoiding the pain of tooth-pulling. The use of ether in the removal of the crowns of the primary teeth in children is certainly unnecessary, and therefore objectionable.

An apprehension has arisen in France, that etherization may be employed in a criminal way, for the purpose of destroying life. During the state of sleep it is thought, that ether might be imperceptibly inhaled to a degree sufficient to prove fatal. Experiments on sleeping dogs have shown, that the toxic principle may be so gradually introduced, as, without producing excitation sufficient to arouse the animal, to cause a depression and extinction of the vital functions. An instance occurred in Edinburgh some time since, of a young woman found dead in her bed, without marks of violence, surrounded with fragments of a vessel of ether, and with a strong ethereal odor. The proof of death by etherization in this case is not perfectly satisfactory; but the possibility of such an occurrence is rendered credible, not only by the experiments just mentioned, but by the well known effects of ether on the nervous system. The medical profession should therefore be aware of such a possibility, and make themselves acquainted with the consequent phenomena, in order to detect them. These would be the negative symptoms from the absence of marks of injury, or dis-

ease; the effluvia of ether, either external to the body, or in the blood; the appearances of cerebral excitement, such as injections and extravasations of the arteries, congestions of the veins, congestion in the lungs, injection upon the mucous coat of the stomach, and perhaps dark color in the blood.

The phenomena of fatal etherization in the human body having been noticed in a single instance only, and those from experiments on animals not being exactly applicable to man, we must wait for future observation to afford us such appearances, as might implicate the life of an accused individual.

In order to prevent the criminal use of ether, it has been proposed in France to pass an ordinance, to prohibit the sale of ether excepting under the prescription of a physician.

I feel obliged to mention another abuse for which this article may be applied. A recent Paris medical gazette contains an account of the administration of ether to a young woman by a dentist, who availed himself of the state of insensibility for the accomplishment of an infamous purpose. The individual accused was in the hands of the police, but the trial not having come on, we are not yet informed what were the real facts. No physician or dentist should think of etherizing a female, unless attended by one of her friends; and no female should allow herself to be placed in this condition, without the attendance of such a companion.

V.

When the use of ether in surgical operations was first proposed, some distinguished physiologists and surgeons considered it as pernicious or useless. The most enlightened of these, guided by a philosophical spirit, investigated the matter for themselves, became satisfied by the amount of evidence which experiment yielded, and with the exception of a few, ultimately relinquished their objections, and adopted the practice. The natural obstacles to truths so very remarkable having given way, the doctrine poured like a torrent through all the countries of Europe. In this part of our country the apprehension of difficulties and dangers was immediately subdued by the accumulating host of successful experiments. Amputations, extirpations, the breaking down of anchyloses, the reduction of fractures and dislocations, and a multitude of other surgical manœuvres painlessly executed, soon swept away all doubt.

In order to form a proper estimate of the value of the new practice, we should endeavor to realize the men-

tal condition which precedes a surgical operation. As soon as a patient is condemned to the knife, what terrors does his imagination inflict! how many sleepless nights, and horrible dreams, and sinkings of the heart does he experience! what apprehensions of dangerous bleedings, of wounds of vital parts, and even of sudden death does he paint to himself! And when to these is added the dread of insupportable pain, what a frightful picture presents itself to his mind! No wonder that many persons are unable to bring themselves to submit — no wonder that some, wrought to desperation, are led to anticipate their sufferings by a voluntary death. Horror of the knife led a gentleman in this city afflicted with a stone in the bladder to commit suicide. When the terror of corporeal suffering is taken from this load of apprehension, the patient may indulge a hope, which leads him to submit cheerfully to uncertain dangers.

Amputations.—In amputations, since ether has been employed, we have never had the unhappiness to witness an instance of the agonizing screams, before so painful to our ears. A few minutes of inhalation have caused the patient imperceptibly to glide through these operations.

An amputation of the thigh was done by Dr. J. M. Warren, July 14, 1847, on a patient filled with apprehensions, and barely recruited from the effects of a distressing accident. Five minutes of etherization threw him into a profound insensibility, from which he shortly awoke to discover that his limb was removed, without any accompanying sentiment but a dream of delightful strains of music. In this case, as in many

others, one of those phenomena occurred, which has been already pointed out. The femoral artery was tied without any movement; ligature of the smaller arteries caused a shrinking, as from pain; when a sponge was passed over the large muscular flaps, cries and violent startings were elicited. Yet this man declared afterwards, that, although he knew when these last operations took place, none of them were attended with any painful sensation. He slept soundly all that night and on the next day was seen sitting up in bed, reading the newspaper, as if nothing unusual had occurred to him.

An amputation for an accident necessarily fatal exhibits not less distinctly the propriety of the practice. A laborer whose limb had been crushed by the wheel of a rail car, was brought to the Hospital in a mutilated state, and it was judged that the only hope of safety rested on a speedy amputation. His ignorance, stupidity, and state of intoxication, led him obstinately to refuse to submit, and all the means of persuasion having been exhausted, it became necessary to leave him for the night. On the following morning having rallied a little under the use of stimulants he was etherized, carried to the theatre, his mangled limb removed and dressed. He survived three days, and on the morning of the third, informed his relations, standing at the bedside, that the doctors had wished to amputate his limb, but that he had refused to give his consent, and died soon after, apparently without knowing it had been removed.

At least twenty amputations have been done under

our eyes without the slightest pain, and generally with rapid recoveries.

Extirpations. Of the numerous instances of partial or total extirpation of the mammary gland two have been already described, both belonging to the class, in which, while intellect continued, the patient declared there had been no pain. We will here specify a perfect case attended with some peculiarities, in which pain and intellect were equally suspended.

A married lady, of delicate constitution, submitted to my examination, a tumour of the right breast, two years ago. So small and irregular was it, that any apprehension of its terminating in a malignant affection appeared groundless, and she was therefore advised not to think of it. Gradually, however, it increased, became tender, painful, quite hard, and exciting much anxiety, its removal was ultimately advised, and was accomplished in May, 1847. Etherization by the sponge was perfectly effected in two minutes. The tumour removed was found to be hard, not scirrhous, insulated by a sac, and the patient awoke from an agreeable dream with the satisfaction of having been relieved without her cognizance. Ether has been thought to be contra-indicated where there is a tendency to cephalic derangement; but in this case, a headache, to which for some years this lady had been a victim, was suspended till five days after the operation, and then recurred without unusual severity. The immense benefit from avoiding the shock of severe pain on the nervous system in so delicate a person was considered as more than a balance for a transient pulmonary inconvenience.

Anchylosis, as a frequent consequence of fracture near or in an articulation, is distressing to the patient, and often embarrassing to the surgeon. The most happy results from ether have occurred in a number of these cases, and the bad consequences of this sequel may be considered as less formidable than they used to be. The great suffering from tearing away the newly-formed adhesions, and the apprehension of subsequent inflammation have often prevented the application of the force necessary to restore the movements of the disordered limb. This may frequently be accomplished in the most satisfactory manner without pain, and so far as our present experience extends, without that degree of inflammation, which is known to have frequently followed this practice.

Dr. Bell, the able superintendent of the McLean Asylum, a department of the Massachusetts General Hospital, conducted to the latter institution a young lady, who had two months before met with a severe injury of the left elbow, followed by a loss of the rotatory movements of the hand, and in a great measure of flexion and extension of the fore-arm. After an examination in the presence of my colleagues, I judged the accident to be a dislocation of the upper extremity of the radius on the external condyle of the os humeri, and in this opinion Dr. Hayward agreed after examining the arm.

The patient and her friends were then informed, that the movements of the joint might be improved by frequent and long-continued efforts of rotation of the hand and flexion of the fore-arm; that the more certain and perfect method of attaining these objects was by forcible

rotation of the radius with violent flexion and extension of the fore-arm, but that this last practice would be attended with very severe pain. While we were still doubting which course to pursue, the thought of etherization occurred, and was suggested to the patient, who with the advice of Dr. Bell immediately assented to it. A sponge was used, and in two minutes she was asleep. Seizing the lower extremity of the os humeri with the left hand, with the right a combined movement was accomplished of rotation of the hand outwards, elongation of the fore-arm and extension or straightening of the elbow-joint. By these means the head of the radius was brought into its place; then by a forcible flexion of the fore-arm the remaining adhesions were broken down with a distinct crackling.

No motion or sign of pain was exhibited. In two or three minutes the patient awoke smiling, as if something agreeable had passed through her mind. She was then asked, whether she felt disposed to an operation for the relief of her arm, to which she replied affirmatively. Being desired to make such movements as she was able, she raised the arm, and to her great surprise and gratification found all its movements restored. She got well without any important inflammation.

A female patient in the Hospital, who had recovered from a fracture of the surgical neck of the os humeri, having a consequent inability to elevate the arm above a horizontal line, was etherized by Dr. H. J. Bigelow, whose patient she was, and he then politely invited me to operate on the arm. The scapula being firmly sup-

ported, the os humeri was gradually elevated till it came in contact with the side of the head, with an audible rupture of the adhesions. Anterior, posterior and rotatory movements were then freely made — all without the slightest shrinking, and the patient awoke with a smile. This occurred in the presence of Dr. Page, of Philadelphia, Dr. Smith, of the Navy Yard at Charlestown, and other gentlemen.

The son of my gardener falling from a tree fractured the internal condyle of the os humeri, and dislocated the fore-arm. The dislocation was reduced by Dr. Wild, Jr., of Brookline, under whose judicious treatment the violent inflammation which followed was subdued, and at the end of a month the limb was restored nearly to its natural size. The severe articular inflammation was followed, as it usually is in such cases, by partial anchylosis. The boy was unable to move the arm more than four or five degrees. Finding that his condition did not improve, it was agreed in a conference with Dr. Wild, that the adhesions should be broken down under the influence of ether.

At the end of seven weeks from the accident the patient was brought to my house by Dr. Wild, and the operation was performed with his aid: Drs. Wyman, Parkman, and J. M. Warren, were present. Etherization was slowly effected, the application of the sponge being required for about ten minutes. The upper arm being firmly held, I operated with the fore-arm as a lever, and produced forcible flexion. The resistance was so great, that at first it seemed impossible to overcome it, but by continual efforts it yielded with a loud crack-

ling, which almost alarmed us. The fore-arm was brought to extreme flexion, and then to extreme extension without any emotion of the patient.

After his recovery from etherization he had much pain till the next day, and the swelling seemed to call for the application of leeches. But before they were applied it subsided, and he had subsequently no unpleasant symptoms. Under the persevering use of passive movements the limb is gradually recovering. The disposition to regeneration of the adhesions in such cases, and the consequent stiffening of the joint, often render a repetition of this process unavoidable.

The common treatment of fracture of the condyles of the os humeri is by the application of close splints and bandages; and I would remark, (not in reference to this case, which was treated exactly as it should have been) that the practice generally recommended is pernicious, because it is adapted to favor the worst consequence of this accident, namely a loss of the power of bending the elbow.

Every surgeon knows, that when a fracture extends into a joint, the effusions of cartilaginous and osseous substance, and the adhesions they produce in and about the articulation, impair its motion in a greater or less degree. To prevent this ill consequence it is advised to take off the splint, and move the arm, at the end of two weeks; but in the mean time the causes above mentioned, with confinement of the limb, render the movement so painful, that the patient resists the operation, and for a time it is abandoned. On the next attempt these difficulties are still greater. It is therefore thought

better to leave the limb to itself till the inflammation has wholly subsided, but motion cannot at this period be accomplished without violence. Further it may be said, that where there is no dislocation, there is no need of splints, nor bandages. The fractured condyle, if displaced, cannot ordinarily be restored to its proper situation, and splints are not required to retain it in its new position, for it will retain it without them.

The practice in this accident should consist in applications destined to prevent inflammation, as leeches, cold water, etc. The arm should be left free from every impediment to its movement, and when the inflammatory symptoms are not alarming, the patient should be compelled to give it motion in three or four days after the injury.

A young man appeared at the Hospital having an ununited fracture of the thigh with two inches of shortening, the result of an accident which happened two months before. An extending apparatus was adjusted, the patient etherized, and extension being made, the limb was elongated. By the continuance of the process the natural length was restored, with the exception of half an inch, and a firm union was obtained. Notwithstanding various precautions, the long confinement of the limb in one posture was followed, as frequently happens, by absolute immobility of the knee-joint. Etherization was employed, and then requesting my colleague, Dr. Townsend, to grasp the lower part of the thigh-bone, I made forcible flexion till the leg and thigh came in contact. This was accompanied with a crepitation so loud, as to be heard throughout the ward. In a quar-

ter of an hour after I found the man in a violent fit of crying, from the impression that his bone had been again broken. On the following day he had recovered from his apprehension, and experienced only a moderate degree of pain and swelling. He soon regained the use of his limb, and was able to walk with a slight halt.

In rupture of the adhesions from anchylosis a great advantage is gained from the state of insensibility, because it prevents the patient from a natural and involuntary counter-effort of muscular contraction, in order to resist a movement he knows will give pain. It may be said, that in all these cases the application of force is unnecessary, because the use of the articulation would be gradually acquired without it. But besides the loss of time, amounting to weeks, perhaps to months, it is doubtful, whether so much motion would ever be recovered, as may be at once attained by the immediate destruction of the adhesions.

Fractures in general do not require the application of great extending force for their reduction. In some, however, the limb being shortened by muscular contraction, the resistance thus opposed cannot be overcome by physical force without a violence both painful and dangerous to the patient. Fracture of the thigh affords an example. In this accident, the broken pieces are commonly displaced and overshot, partly from the circumstances of the injury, and partly from the obliquity common to this and most fractures of the long bones. The overlapping bones must be brought to correspond at their extremities, in order to prevent shortening, deformity, and difficult union; but this is opposed by

the powerful contraction of irritated muscles. Ether enables us to annihilate these contractions, and bring the limb without pain to its proper situation.

The patient having been put to sleep, the surgeon extends the limb, brings the fragments to their natural relations, applies permanent extension and counter-extension, and supports the whole limb by lateral pressure, especially about the fractured part; if afterwards displacement occurs, he repeats the same process. At the end of five or six weeks, he attempts to overcome the stiffness of the knee-joint by flexion of the leg, and when, as often happens, this cannot be accomplished without severe pain, it can be done most happily in the etherized state. Nearly the same method may be pursued in the treatment of fracture of the neck of the thigh bone.

In overshot ununited fractures of some duration, the difficulties are greater, but even these may be overcome if too long a period since the fracture has not elapsed. This is shown by the case last described, (page 43,) and another may here be adduced with circumstances somewhat different.

In the winter of 1847, a man met with a fracture of the upper third of the thigh bone, with a shortening of between two and three inches, and an anterior projection of the upper fragment. Great pains were taken to restore the length of the limb, and remove the deformity. The straight posture, the flexed, the apparatus of Jarvis and bed of Amesbury were successively tried; but all these plans were abortive, because the patient could not bear the requisite pressure, and two

months elapsed without union. After a little respite, to allow the healing of excoriations, etherization was resorted to, the limb brought down by an extending apparatus, and the same process repeated, when the bones became displaced at various times afterwards; compression also was applied to the upper fragment, and a cure accomplished with a very slight shortening.

Whether the sensitiveness of this man was modified by the inhalation, or by any other cause, we pretend not to say. Certain it is, that after the first application, he never suffered severely, and we were all struck with the fact, that this man, so irritable before etherization, became quiet and docile afterwards.

Dislocations.—The advantages obtained by muscular relaxation in fractures, as noticed above, are equally great in the reduction of dislocations, since the principal impediment in these cases arises from the same cause. It is therefore scarcely necessary to illustrate them by other facts. But it may be stated, that two cases of dislocation of the os humeri were immediately reduced by Dr. Parkman, one of the surgeons of the Hospital, under the influence of ether, one of which had already resisted powerful efforts for reduction without ether. We have great hopes of hereafter seeing some of the difficult dislocations of the hip and shoulder, hitherto the opprobria of surgery, compelled to submit to the power of ethereal relaxation.

The remarks before made on the muscular relaxation from ether satisfactorily show, that by it we produce a condition of the muscles, which permits extension with a moiety of the power otherwise required.

Operations on the bones.—The bones are the subjects of severe, long-continued operations, from the shock of which the patient sometimes sinks. Three instances of operations on the bones may be noticed, happily conducted by the aid of ether.

First, a necrosis of the tibia of two years standing was submitted to the hands of Dr. Townsend, while knowing that the etherization must be carried to a great extent, I carefully watched its effects. An incision of six or seven inches, a number of sections of the enclosing new bone, and the removal of many portions of sequestra required a period of forty-five minutes. Etherization by a sponge was continued with very slight interruptions for thirty minutes without suffering, but the patient's pulse failing at the end of this period, it was intermitted, and he awoke soon after. Immediately he became very restless, and with many odd remarks, clamorously demanding "divine ether," it was given for nearly fifteen minutes longer. The operation was happily concluded. The man continued very gay for a couple of hours, experienced no bad effects, and recovered rapidly.

The second case was one of ununited fracture of the radius, treated by a seton. This patient had broken his fore-arm about six months previously; the ulna was consolidated, the radius remaining ununited. What produced this result was not ascertained. As the man was perfectly healthy, it could not be attributed to a constitutional difficulty, but the probable cause was his movements of the hand in rotation during the treatment.

The arm was left for some time without any application, except stimulating frictions adapted to restore a healthy condition, and then a seton was introduced. The direction of the fracture was such, that the passage of the needle across from without inwards would cause it to impinge on the ulna. In order to avoid this difficulty, a dissection was made on the anterior face of the radius. The needle could not, however, so close was their junction, be forced between the extremities of the fragments. It therefore became necessary to divide some of the adhesions with a knife, and to open a passage by a small chisel, aiding this process by such a posture of the arm as seemed most to favor it; then the needle, being passed from without inwards, and from before backwards, was made to issue behind the ulna. From ten to fifteen minutes were required; etherization by the sponge was continued through the whole operation, and the patient awoke after its removal, in a happy state.

Inflammation succeeded, with symptoms so violent, that the seton was withdrawn in ten days — a period too short, as was afterwards found, for perfect success; the motion, though diminished, being perceptible at the end of seven weeks. After this time, it rather increased than diminished, and another operation was required. The patient was etherized as before; an incision, about two inches long, made on the outer edge of the fracture; and at a right angle with this, another incision, an inch long, over the back of the radius. The fractured extremities being well exposed, their ligamentary adhesion was divided by a knife, and a

peg of ivory, two inches long, passed between them. Then, in conformity with the advice of Dieffenbach, a hole was bored in the extremities of the upper and lower fragments, and a peg inserted in each. The patient was quite awake through the process, and talked humorously, but did not acknowledge pain; thus presenting distinctly one of the instances of the existence of the intellectual faculties with the absence of the sensitive; and affording, of course, a distinct objection to the hypothesis of Mons. Longet, which maintains that the cerebral lobes are always etherized before the sensitive ganglia.

In the preceding case, slight variation in posture favored the passage of instruments, which without it could not be made to penetrate. I noticed the same fact in two such operations on the os humeri, performed during the last year with a successful result; one of them on an attendant of the Hospital, the other on a female about forty years old, in whom the brachial artery, interfering with the passage of the needle, required a dissection to remove the vessel from its course. It may be useful to remark, that in the last case, as well as some others, I have seen the want of union to be the result of an application of splints and bandages so close and long continued, as to check the action of the blood vessels and nerves.

Sir Benjamin Brodie, in one of the valuable practical papers with which he so often favors the public, speaks of a number of cases of ununited fracture attributable to general debility. Such cases I have also seen; but those which have occurred within the last two or three

years have arisen principally from local weakness, caused, as I have said, by too great pressure from splints and bandages.

The third of these cases was that of a young Portuguese seaman, who had a fracture of the leg at sea, about a year before. On the outer side of the leg, in the situation of the upper part of the fibula, appeared a considerable projection, such as might be formed by an extraordinary effusion of osseous, cartilaginous and fibrous substance. The patient could not use his limb, but his most urgent reason for asking aid was, that he experienced incessant pain in the enlarged part. Many applications were made without mitigating his sufferings.

Having been requested by Dr. Townsend, whose patient he was, to examine the limb, I suggested the expediency of cutting down to the bone, in order to ascertain what the nature of the difficulty was, whether the peroneal nerve might be compressed by the bony matter, whether there might be a collection of fluid, an aneurismal formation, or other disease of the bone. To this proposition Dr. T. kindly consented, and I made an incision four inches long on the outside of the fibula, along the surface of the tumour, and on a line from the head of the fibula downwards towards the malleolus. The peroneal muscles were separated, dissected from the surface of the tumour, and with them a large branch of the peroneal nerve lying in contact with the bone. The parts were held aside, in order to expose the tumour more fully — a process which would certainly have been very painful, if the patient had possessed his sense of feeling at the time.

The bone was then penetrated by a perforator, to the depth of an inch. The perforation being enlarged, so as to admit the little finger, disclosed a cavity, two or three inches in length, lined by cellular parietes, constituting the disease known by the name of spina ventosa, or osseous sero-cystic tumour. As there was no sign of malignity, the proceeding which seemed best, was to remove the externo-lateral wall of the bony tumour, in the hope of relieving the pain produced by its pressure on the surrounding parts; leaving the question of amputation, and that of excision of the whole bony tumour, to be decided by subsequent events.

The operative process, including some intermissions for consideration, lasted nearly thirty minutes. The patient was perfectly insensible through the whole, in consequence of the continuous application of the sponge. He awoke in a pleasant state of mind, and had no bad effects from the ether.

After the wound had healed, pain recurred, and the tumour regularly enlarged. The peroneal branch of nerve on its surface became inflamed, so that the slightest pressure on it was insupportable, and the outside of the foot and leg occasionally lost their sensibility. It now seemed necessary to remove the diseased bone; but this could not be done without the destruction of the peroneal nerve and artery, and also, the interosseous space being occupied by the tumour, of the anterior tibial artery and nerve. The consequence of these lesions would have been paralysis of a good part of the limb, and probably a gangrene which would involve the whole, and perhaps prove fatal.

It was determined, therefore, to amputate the tibia at the place of election, and excise the whole fibula. This was accomplished, a good flap procured from the posterior part of the limb, and the patient is now recovering.

The diseased part of the bone was found to be six inches long; its circumference was nine inches. It contained a single cavity filled with yellow serum, which on opening the tumour was projected between two and three feet — thus showing it had exerted on the bony cavity and its membranous lining a strong pressure. The aperture made in the first operation had been closed by a fibrous membrane.

This patient required at least twenty minutes for etherization. At the end of this time, he was insensible, and experienced no bad symptom from ether afterwards.

Strangulated Hernia.—One of the earliest thoughts that occurred after the introduction of ethereal inhalation, was its applicability to strangulation of the viscera. In various amputations, we noticed a loss of contractile power in the muscles while etherization continued; and this observation was confirmed by a number of other etherized cases, in which the muscular contraction first occurring was succeeded by remarkable relaxation. Hernial strictures caused by, or connected with, a state of muscular contraction, might be expected to relax under the same influence, and allow the return of protruded organs. The use of tobacco, the warm bath, and copious bleeding, have been employed with this intention. Even the organic muscles may be affected

by such influences; and hence, no doubt, arose the suggestion made by Nysten, of the usefulness of ether in colic — a suggestion made in the history of the first six cases of etherization, without a knowledge of its mention by Nysten.

Two cases only of strangulated hernia treated by ether have come within our experience, one of which we shall mention.

In the month of June, 1847, Dr. J. M. Warren was called in consultation to a female patient, laboring for eight days under strangulated crural hernia. She had fœcal vomiting, great tension of the abdominal muscles, with much pain and tenderness in the tumour. Taxis having been unavailingly attempted, she was placed under ether, preparatory to an operation. The abdominal muscles previously tense were entirely relaxed, pressure on the tumour was made without pain, and the hernia readily reduced.

Notwithstanding the long period of strangulation, she recovered — a fact which would be more surprising, had we not frequently noticed it in strangulated crural hernia. In looking for a cause of this occurrence, we have been led to impute it to the comparatively small volume of this species of hernia.

My friend, Dr. Hosack, of New York, has given an account of a strangulated hernia reduced by ether, in the Boston Medical and Surgical Journal, of August 11, 1847.*

* A fact occurred at the time of writing these lines, which may be worth mentioning. Dr. Wales, of Jamaica Plains, brought to me a little Irish infant, three months old, with a

Feigned Diseases.—Ether has been employed successfully to detect the imposture of feigned diseases. In Europe it is not uncommon among the poorer classes to find individuals who, in order to excite compassion, obtain charity, procure admission to a hospital, or avoid some unpleasant requisition, feign contractions of the limbs, deafness, inability to speak, etc. Etherization overpowering the will which maintains these appearances, the contracted muscles relax, the deaf man hears, and the dumb speaks. Although such impositions are comparatively rare in this country, we have occasionally seen them, and had opportunity of observing the temporary restoration of limbs affected with distortions, which before seemed permanent.

Tetanus.—Etherization may be employed for the relief of tetanic spasm; but while it mitigates the distress of the muscular contractions, it cannot be expected to overcome the inflammatory action of the spinal membranes, or the medulla they envelope.

Neuralgia.—The paroxysms of neuralgia may be relieved by ethereal inhalation, and great comfort obtained by the interruption of long fits of this affection. Sometimes the paroxysm is quite broken up; but I have seen no instance of a final cure. Such, however,

large congenital strangulated inguinal hernia, of two days' duration. After examining the tumour, I was about to etherize the child, when it fainted, and appeared to be in a dying state. The proposed etherization was suspended, and while awaiting the event, we heard a movement of the bowels; the hernia retreated, an evacuation followed, the patient revived, and did well. In this instance, the state of faintness produced a muscular relaxation, which removed the impediment to the return of the viscera.

I have strong hopes, may hereafter occur, as the result of a patient and repeated use of this practice.

Strictures.—Spasmodic or inflammatory contractions in muscular tubes destined for the admission of alimentary substances, or for the expulsion of excrementitious matters, constitute a class of affections often very difficult to overcome. Organic strictures, or those which result from an adventitious deposit of healthy or morbid particles, would scarcely seem to come within the limits of ethereal practice — yet I have seen even in these cases good effects from its influence.

In the latter part of July, 1847, a gentleman applied for a difficulty in swallowing, as he called it. His food, he said, passed down to a certain point, and after being retained there for a while, was rejected. Suspecting he had a stricture of the œsophagus, I attempted to introduce the balled probang, but found it impossible ; the sponge was then put to his nostrils. In two minutes, the patient repeatedly spoken to did not reply. The instrument was now passed down as far as the stricture without excitement or movement, carried through it, and moved up and down three or four times. The movements through the stricture excited œsophageal and gastric contractions by reflex action, without awakening intellect. After the removal of the instrument, the patient being spoken to, awoke, and said that he had no knowledge of its introduction. Graduated globes and pyramidal wedges were employed many times afterwards; and when, as often happened, the stricture resisted the passage of the instrument, it was overcome by etherization. The patient was re-

lieved, and returned home, with instructions for a continuance of the process.

Stricture of the urethra, producing retention of urine, is a very fair subject for the practice. When this retention has continued long, a great accumulation of urine taken place, accompanied with much suffering, after a succession of ineffectual efforts, the surgeon is, by a natural impulse, tempted to a forcible use of instruments, and the frequent consequence is a disorganization of the urethra, from which it never recovers. Experience has taught, that when moderate and judicious trials of bougies and catheters do not succeed, these instruments should be laid aside, and the patient left to the action of those remedies which subdue inflammation and produce relaxation. Leeches, the warm (sometimes the cold) bath, and narcotics, will often succeed, with the help of nature, where instruments have failed. Etherization is here a happy auxiliary, as may be illustrated by the following case.

Dr. J. M. Warren was called in consultation to a gentleman, who had suffered from a retention by stricture for ten or twelve hours. It not being possible to pass an instrument without violence, leeches, the warm bath, opium, etc. had been ineffectually used. Great distension of the bladder having taken place, attended with extreme suffering, it was agreed to etherize the patient before any further efforts were made. As soon as etherization was accomplished, a few drops of water began to trickle away, and the instrument was passed without difficulty. The passage being open, no further obstruction occurred, and he recovered in a few days.

The following case also illustrates the power of etherization in causing relaxation of the urinary passages. In the month of October, 1847, a man was brought into the Massachusetts General Hospital with an infiltration of urine. The bladder had ruptured apparently in the perinæum, and the urine had infiltrated the scrotum and abdominal parietes to a great extent.

The state of the bladder was explored on the surface of the abdomen and in the rectum. The abdomen was extremely distended, but on its right inferior side was found to be soft, and this fact led to the inference, that the abdominal hardness was not caused by distention of the bladder. This point being settled, I next proceeded to examine the state of the urethra, and as the patient was very sensitive, and in great pain, he was etherized. Instruments passed into the canal were, as I expected, interrupted, none could be made to approach the bladder, but immediately after etherization there was a discharge of urine by the urethra. On examination by the rectum the bladder was not discovered, but a collection of knotted tumours was found behind the usual situation of the prostate gland. There was then no distention of the bladder, and of course no occasion for its puncture.

The most important thing to be done under existing circumstances, was to relieve the infiltration as much as possible, by giving vent to the urine in the cellular texture. I therefore made an incision in the most dependent part of the scrotum, on each side of the raphé, and full two inches long. The patient was ordered into the warm bath, had warm injections into the rectum,

and etherization once in six hours. On each etherization there was some discharge of urine from the urethra.

On the day following, however, the symptoms were aggravated, there was great distress, great prostration, the scrotum black, the abdominal swelling increased, extended over the left flank to the spine, and covered by an erythematous eruption. The man's case seemed to be nearly desperate. I determined then to make a large incision through the abdominal swelling, and to penetrate the tumour wherever it was.

The patient being again etherized, an incision three inches long on the prominent part of the tumour, followed by a careful dissection, at length produced a small jet of urine. The aperture being widened by a probe, was then freely dilated, and a copious urinary discharge, accompanied with flocculent lymph, followed. The bed was inundated. The finger passed through the aperture, discovered a large cavity extended over the left portion of the abdominal parietes, and towards the scrotum. It now only remained to procure a dependent opening for the urinary fluid. In order to accomplish this, a lithotomy-staff was passed through the abdominal incision into the left scrotum, then insinuated from within the scrotum outwards through the scrotal incision made the day previous. On the staff the cellular texture of the scrotum was divided the length of the external incision. By means of this, a free drainage of all the stagnant urine was obtained;—the symptoms were immediately alleviated. On the day following, there was no suffering; he took nourishment, and appeared convalescent.

This patient seemed to be doing well for the six days following. On the seventh, he began to fail, and on the eighth died, without any new symptoms which could account for his death. On examination, the vesiculæ seminales, vasa deferentia, and ureters were found to be indurated — the latter were enlarged through their whole extent. One of the kidnies presented various cavities, produced, no doubt, by revulsion of urine from the bladder. This organ was very much contracted, its mucous coat ulcerated, and in one or two points this coat formed hernia, from the powerful contractions of the bladder on its contents. The rupture of the urethra was a little in front of the bulb, and about half an inch in length. Before the rupture appeared its cause, a membranous prolongation stretched obliquely across the urethra.

In this case, ether operated favorably in two ways; first, by occasionally producing a small flow of urine; and second, by the absolute rest it induced during the second operation, in consequence of which, a dangerous and uncertain dissection could be made with perfect tranquility.

Lithotomy.—This is an operation whose terrors may be greatly diminished by ether. The exquisite suffering, the spasmodic constriction of wounded muscles, the irregular pouch-like contractions of the muscular coat of the bladder, under its use, must cease to act as obstacles, and their cessation give an ease and freedom of mind to the surgeon, which might enable him to encounter other dangers with confidence that he can subdue them. The stone in the bladder, as I have had

occasion to notice, is so exceedingly rare in this region, that during forty-five years I have not encountered as many instances, including together cases of lithotomy, lithotrity, and those not subjected to any surgical operation. And since the introduction of etherization, I have not had occasion to perform the cutting operation. For, although called on to do so, I have been able to avoid its dangers by the operation of lithotrity with happy results. This, however, brings its peculiar difficulties and dangers; the latter never in my practice amounting to any thing formidable, but the former much exceeding in extent those of lithotomy. The irritable state of the urethra, the great sensibility of the bladder, the partial and general contractions of the vesical muscles, the lodgement of broken fragments in the urethra, the tedious repetitions sometimes required concur to embarrass the surgeon, and render his approach to this process less agreeable than to the more dangerous one of lithotomy.

Among the occurrences of lithotrity, the most troublesome of those already named is a partial contraction of the bladder. When the operation has been frequently repeated, I have had occasion to notice, that the stone-breaker, after seeming to enter the cavity, and after having actually entered the prostatic portion, could not be brought into contact with the stone; and on passing the finger into the rectum, it has been found that the instrument was arrested immediately beyond the prostate, by impinging against the vesical tunics, crowded down towards the urethral aperture by a contraction apparently resembling the hour-glass contrac-

tion of the uterus. By the aid of a finger in the rectum, the instrument may be conducted in such cases into the superior region, and the stone thus attained. Those expert in lithotrity may perhaps believe, that this difficulty might be obviated by a sufficient distention with water; but they will recollect, that this distention, even though moderate, produces a painful disposition to expel the liquid, and that it often is expelled in a very short time, especially in females. So often has this occurred, that I have been led to apprehend, that the stone may generally be seized with as great facility, and as little danger of including the vesical coats without, as with, this preparatory step. Dr. Randolph, the most able lithotritist of this country, has, I think, the same opinion. Etherization is especially adapted to obviate the accident alluded to.

A gentleman applied to me to perform the operation of lithotomy on himself. He had been examined, and a stone found; but the consequences of this examination, although it had been carefully conducted, led him to the conclusion, that he could never submit to the irritating repetitions of lithotrity. After a full conversation with him, he agreed to undergo another examination under the influence of ether; and so far from suffering while it was made, he described his sensations to be altogether pleasurable. No irritation followed, and shortly after he underwent lithotrity. The stone, about the size of an almond, was crushed, and the greater part of it removed by a single operation: a second completed its demolition. The whole process was without pain; and the patient speedily, and

to himself unexpectedly, was restored to health and usefulness.

The following case will further illustrate the use of ether in favoring the exploration of the urinary bladder, when a stone is suspected to exist. Dr. J. M. Warren was requested by Dr. Morrill to see a little boy, four years old, who had symptoms of stone. The child was utterly intractable, until by the application of ether he was put to sleep, and then an examination being made, resulted in the discovery of a stone in the bladder.

As this disease scarcely ever occurs here, it was a matter of interest to ascertain, whether any accidental cause might have given origin to it. The only known occurrence, to which the concretion could be attributed, was the following. The child was passing his water in the street, and, while doing so, was thrown down by another boy, and dragged over some gravel. On the following day he complained so much, that his mother examined, and found a gravel stone in the urethra, which she removed. In four months afterwards, he began to exhibit symptoms of stone, which have continued to increase in violence for about two years and a half.

The symptoms became so distressing and so strongly indicative of stone, that it was thought necessary to make an examination. Such was the pain, that violent contractions of the bladder took place, accompanied with protrusion of the rectum, so that no examination could be accomplished until ether was employed, when a sound was introduced, and a gritty substance discovered. The examination did not, however, give full

evidence of the nature of the affection, and required repetition at three different times. In each instance, etherization was employed in the most satisfactory manner.

On November 16th I saw the boy with Dr. Mason Warren and other gentlemen; we all became satisfied of the existence of a very small stone in the bladder. The smallest lithotrity-instruments would not pass the urethra. The operation of lithotomy was therefore immediately performed by Dr. Mason Warren by the crescentic or bi-lateral mode, and the stone removed. Ether was invaluable during the examination and operation.*

In this connection may be noticed operations for vesico-vaginal fistula, generally very painful and very unsuccessful. These operations have been performed by Drs. Hayward and J. M. Warren, with perfect freedom from suffering, and hence greater facility afforded in bringing the parts into view, and allowing of their more perfect adjustment.

Operations on the Rectum.—Painless applications of ligature in hæmorrhoidal and prolapsed excrescences of the rectum, operations for fistula in ano, and other diseases of these parts, might be mentioned; but not presenting any thing remarkable, we shall pass them over.

Cautery.—The actual cautery is viewed with so much dread in this country, and I believe also in Great Britain, that we rarely have been able to avail ourselves

* See Appendix C.

of its great benefits. Lately having the power to give the assurance, that it might be employed without the usual pain, a consent has been obtained, which, although at first reluctant and skeptical, has, by many successful trials, now changed to a ready and perfect confidence.

In the month of May, 1847, there being an annual meeting in Boston of the State Medical Society, occasion was taken to invite the members to witness some operations about to be performed in the hospital.

After two operations with etherization, which succeeded perfectly, a delicate female, laboring under a disease of the spinal marrow with general neuralgia, was subjected to the actual cautery. A space on each side of the dorso-lumbar region of the spine was cauterised by red-hot irons, one of which was an inch square, passed up and down slowly three times on each side without the slightest suffering.* All were struck with admiration at this result, and none more than myself, although I had witnessed it before. In truth it may be said, the change of nervous susceptibility by etherization is so very remarkable, that, after all the cases we have witnessed, every new operation with ether excites fresh wonder, and leads one almost to doubt the evidence of his senses.

Dysmenorrhœa. — The pains of dysmenorrhœa, though temporarily relieved by the use of opium, are very distressing to many individuals. The practice of the late ingenious Dr. Mackintosh, of Edinburgh,

* When the iron is heated to whiteness, pain is known to be less than when it is only red-hot; but, as ether was to be employed, this condition was not thought necessary.

promised for a time to afford the desired relief; but the hopes it excited have now in a great measure died away, and although it is used with various modifications by some practitioners in Europe, and has been partially adopted in this country, the general sense of the profession, so far as I can judge, is not favorable to it. It may be doubted, also, whether the anatomical fact, on which his practice was founded, is generally true. He exhibited to the author a number of specimens taken from patients affected with dysmenorrhœa, in which existed a very contracted state of the os uteri, and to this state he attributed the difficult passage of the uterine excretion. In some very severe instances of this derangement the aperture has been found to be quite as large as in healthy persons.

When a new remedy is brought forward with some little success, our profession naturally fly to it, and employ it with perhaps too little discrimination in a variety of affections. It soon wears out, and is either wholly abandoned, or used to a very limited extent.

Dysmenorrhœa, intractable as it has been under medical treatment, and breaking down as it does the constitutions of many young persons, is a pretty fair subject for judicious experiments, and may perhaps be considered as not exposed to the objection alluded to. As etherization relieves other pains, why may it not relieve the pains of dysmenorrhœa? It may be expected to do so temporarily at least, and with less ill consequence than opium and most of the narcotics. The results in those cases, in which I have thought proper to recommend it, have not, for the want of time,

been sufficiently numerous to justify any general statement in regard to its utility. They have been, however, so far satisfactory, as to lead to its trial in all severe cases.

An English gentleman, resident in this place, came to me a few months since for information on this subject. He said, that his wife had from her youth been afflicted with atrocious pains at the monthly period. During its continuance, she suffered so violently, as sometimes to produce convulsions. He had, while in England, naturally consulted the most able and experienced practitioners; but as yet nothing had been found to be permanently beneficial, except opium.

Soon after, I had an opportunity of seeing her in one of the paroxysms, and suggested such means as seemed likely to give relief. At the next periodical occurrence, the symptoms being of an alarming character, etherization was employed, the distress was at once relieved, and the paroxysm broken.

Some months after the first application, this patient had another severe and alarming paroxysm of her complaint. Opium and other remedies were employed without important relief. Ultimately, etherization was resorted to, with the effect to mitigate the pains, which, however, recurred from time to time, until a pint of ether had been consumed. The paroxysm did not terminate, until there was an expulsion of a membranous formation, similar to that described by Dr. Oldham in the London Medical Gazette of April 16, 1846.

Midwifery.—The application of ether for the alleviation of the pangs of labour may seem to claim atten-

tion. The reversal of the decree of nature, which in human kind connects suffering with parturition, would indeed be a phenomenon as remarkable as any medical science has revealed. There is no parity between the abolition of pain in surgical operations, and the abolition of the pains of labour. The former is only a part of that action of a general law for preservation against injury, in consequence of which, whenever a foreign body threatens to impair the integrity of an organ, pain is produced, and the organ is instinctively withdrawn from the contact. Hence each organ has its sensitiveness peculiarly adapted to its own protection: — the eye is irritated by an atom which would produce no impression on the skin; the skin is exquisitely affected by the cut of an instrument which would cause little pain in a ligament; while the ligament, unconscious almost of the presence of a knife, is severely pained by those distortions which might lacerate. Nature has thus given to each part a sensibility which warns it of external danger; and by this warning she affords, to a certain extent, the means of escape. A kind provision also for the relief of internal pain and disease is bountifully provided in the copious stores of the Materia Medica.

There is therefore nothing contrary to the laws of nature in the removal of pain from surgical operations. Some, indeed, have said, that such pain is, as a final cause, necessary to warn the surgeon of his approach to textures, or organs, it would be dangerous to touch; but this opinion will, perhaps, not bear very close examination. The outer coat of a great artery, for exam-

ple, apart from the accompanying nerves, is not very sensitive; nor are the pleura, the peritoneum, tunica arachnoidea, dura mater, — all of them organs not to be wounded without danger. Some nerves, whose integrity is essential to life, possess a sensitiveness less than those distributed to parts comparatively unimportant. Dissection of the par vagum from the coat of a tumour is accomplished with less pain, than that of one of the cervico-spinal nerves. The proper guide to the surgeon is not the variable sensitiveness of the organs he is dealing with, but his knowledge of their situation and relation. Suffering, then, is no essential or useful part of a surgical operation.

The law which regulates the pains of labour is a general law, which cannot be changed by the power of science. Its final cause is sufficiently plain to show its utility and necessity. Like most general laws, this, however, may have its exceptions, and we may increase the number of these exceptions by the aid of art.

Besides the objections to the universal application of ether on the grounds exposed above, there are others of a specific character, which can hardly fail to occur in this department of practice. The use of so powerful an application through the whole period of a natural labour would, in proportion to the term of that labour, increase the dangerous tendency to organic excitation; and when this period is very protracted, it might bring on distressing derangements of the stomach, brain, spinal marrow, or uterus. Another objection to its free employment is, that it does, in many cases, suspend the uterine contractions.

The cases, then, in which ether could be properly resorted to, should be considered as exceptions, and we will specify the following: 1st, in a natural labour, when the pains are uncommonly severe, especially the terminating pains in a first parturition; 2d, during limited periods of labours prolonged by a preternatural cause; 3d, when, from the peculiarity of constitution, the patient cannot, without danger, support the usual amount of suffering; 4th, for the purpose of obtaining relaxation in irregular contractions of the uterus, such, for example, as the hour-glass contraction after delivery.

These suggestions are founded principally on a general knowledge of the effects of ethereal inhalation, and not on the results of my own personal experience. My son has, however, employed etherization in obstetrical practice with results which appear to me in the light of exceptions to the general law.

Among other instances, the following may be mentioned. A lady was ill eighty-four hours, during forty of which she was more or less etherized with great relief, and passed through the terminating pains without any symptom of suffering, or any recollection of them. I had an opportunity of seeing this lady after her confinement repeatedly; found her in an excellent state, and without any unpleasant consequence. Those who wish for particular information in regard to this practice, may consult the publications of Dr. Channing, of Boston, Dr. Simpson, of Edinburgh, and Professor Dubois, of Paris.

Death.—A very important use of etherism remains to be noticed. In a former part of these pages, its ap-

plication for the relief of the last distressing state of pulmonic inflammation has been transiently adverted to. Since the establishment of ethereal practice in surgical operations, its former utility in mitigating the agonies of death has led me to employ its influence in a more free and decided manner. And so far as the trials have extended, they serve to justify its use in a great number, and I hope I may say without enthusiasm, in the majority of instances. Should this prove, on a full trial, to be the fact, the value of the discovery will be greatly enhanced, since the number of those who are called on to suffer in the struggle between life and death, is greater than that of those who are compelled to submit to the pain of surgical operations.

I am fully aware, that the agony in the dissolution of the bond between the bodily frame and its spiritual tenant, is not so great as it is believed to be; for, having questioned a great number of persons passing through the last stage of earthly existence, whether they suffered pain, the answer has been almost uniformly in the negative; and on inquiring what sensation was experienced, the reply has been such as to lead me to consider it an undefinable sense of discomfort. The intellectual faculties appear to be so clouded and confused, that they are unable to take cognizance of the agitation which convulses the physical organization.

There are, however, exceptional cases, in which there is great bodily suffering; and there is in all men an instinctive dread of the pains of death. If we find the means of preventing or relieving these pains, the

great change may be viewed without horror, and even with tranquillity. He who would experience a real euthanasia should not, however, trust merely to the virtues of ether, but should also have settled his accounts with this world, and be well prepared to settle those of the future.

In illustration of the practice alluded to, may be mentioned the case of a lady, who died of dysentery in the summer of 1847, at the age of ninety. She had been my patient more than forty years; and during that time, besides heavy domestic calamities, had undergone a number of attacks of pleurisy, one of pericarditis, a severe and protracted bleeding from the stomach, with symptoms of malignant disease of this organ. She was once dangerously poisoned by eating partridge; moreover, by a fall she had a fracture of the neck of the thigh-bone, and soon after her restoration, was attacked with senile mortification of the foot, from which, having suffered months of intense pain, she wholly recovered.

Very temperate in her eating and drinking, and of a religious character, she was cheerful, notwithstanding all these visitations; appeared to enjoy life more as she grew older, went out freely, and made two or three excursions into the country within a few weeks of her last illness.

The dysenteric attack, which terminated her career, accompanied with symptoms of unusual severity, was only relieved for a very short time by the use of opium. After more than two weeks of illness, violent pain occurred in one of the feet, with discoloration,

ending in gangrene. The pain of mortification suddenly ceasing under the use of opium, that of the abdomen returned, with convulsive twitchings of the limbs; and other remedies failing to mitigate these symptoms, inhalation of ether was employed with perfect relief.

From the first inhalation to the period of her death, five days elapsed, during which a considerable number of etherizations were used, and with such effect, that, as soon as any suffering occurred, she desired ether. In the intervals, her mind was clear, she arranged such worldly matters as remained unsettled, received the consolations of religion, and finally under ethereal influence her spirit imperceptibly took its flight.

Vivisections.—An excellent use of ether may be made in regard to animal vivisections. The people of this country, in common with their English progenitors, have always viewed the torturing of living animals for scientific purposes, with invincible repugnance. Great has been the sacrifice of improvement in physiology and surgery, which this sentiment has cost the medical profession. Ether enables us to lull the sensibilities of the victim, tranquilly pursue the natural workings of the internal organs, and the changes which take place from experimental applications; while the student of surgery can accustom himself to those gushes of the vital fluid, which, in the human body, are viewed with so much terror by the unpractised.

Animals of any size may be etherized in a box, or by covering the head with an India-rubber sack, into which a mixture of ether and atmospheric air is forced.

Dr. B. Brown, of this city, in the spring of 1847, was the first in this country, so far as I know, to employ etherization for the prevention of pain in surgical operations on animals. Latterly, others have satisfactorily adopted the same practice.

General Conclusions.—The views we have taken on this subject, suggest the following inferences:

1st. Inhalation of ether produces insensibility to pain.

2d. Ethereal insensibility, judiciously effected, is not followed by any dangerous consequences.

3d. Its administration is easy, and usually requires but a few minutes.

4th. Individuals of all ages may be safely etherized.

5th. Individuals of the same age are susceptible of the influence of ether in variable degrees.

6th. Surgical operations may be done under the effect of ether, which could not be done without.

7th. Operations very short, and not very painful, especially those about the head and neck, are best done without ether.

8th. The shock of the nervous system is greatly diminished by etherization.

9th. The use of ether has increased the number of successful operations, by encouraging a resort to them at an earlier period of disease.

10th. The use of the sponge is more safe and easy than that of any special apparatus.

11th. A special apparatus is convenient for some peculiar cases.

12th. The existence of chronic pulmonary disease rarely forms an objection to etherization.

13th. Etherization may often be employed advantageously as a substitute for narcotics.

14th. The employment of ether does not retard the healing of wounds, nor give them an unfavorable character.

15th. The pains of death may often be relieved by etherization.

VI.

For the most part the horizontal posture is favorable for etherization, because the patient is more easily composed. In the early practice, the tube and bottle being used, the patient almost constantly assumed the upright posture; but we found reason to believe, that etherization was more speedily and perfectly accomplished in the horizontal, and therefore have made it a general rule to adopt the latter in preference to the former. In some operations, however, as for example in stricture of the œsophagus, this would be impracticable.

The sponge will be found more convenient than any apparatus in the majority of instances, though we think that the mouth-tube may sometimes be proper. The sponge is preferable, because it requires less effort to inhale through it, and because the atmospheric air introduced with the ether removes the danger of asphyxia. Perhaps a longer time is required; but this is a minor evil, and readily overcome by a little patience.

The sponge should be of an excavated form, in order to accommodate the projection of the nose. The wind-

ing indirect channel of the nostrils, the more natural passage for the ærial fluid, diminishes the impulse on the lungs, and the consequent propensity to a troublesome cough. The sponge previously moist, saturated with ether of the purest quality [vide Appendix A], should be closely applied to the nasal apertures with due caution to prevent the introduction of the fluid into the mouth and eyes; and its position should be occasionally changed, on account of the gravitation of the ether to its inferior part. Some patients prefer employing the sponge themselves, and this is true particularly in regard to parturient females. And so far as our experience has extended, it has given us reason to believe, that the practice of committing the sponge to the patient may be advantageously adopted in a great number of instances. When the lungs are irritated, and cough produced, the sponge may be momentarily removed.

The volatility and combustibility of ether should be kept in mind when it is employed by candle-light. Although there is no great reason to fear an explosion of the lungs, it is quite possible that the patient and the surgeon might be unpleasantly burnt by the careless approximation of flame. A patient of mine had been advised to apply a bandage dipped in ether for an affection of one of his fingers, and having secured the bandage by a piece of thread, in the absence of a cutting instrument burnt off the string by the candle, in consequence of which he experienced something of a cauterization.

The quantity of ether employed has been thought to require exact measurement; and, among others, the ce-

lebrated surgeon and author, Monsieur Bonnet, of Lyons, has invented an apparatus for accomplishing this purpose. The proper measure of quantity is its influence on the patient; and this influence must be obtained, whether it require drachms or ounces. As a matter of economy the measuring apparatus would be useful.

It is to be taken into view, that the quantity of ether inhaled is gradually diminished by the reduction of temperature from its evaporation. The salivary excretion from the mouth is sometimes seen frozen on the sponge by cold from this evaporation. The ether in the sponge will of course become colder during the application; its volatility, and therefore the quantity inhaled, consequently lessened. The addition to the sponge of fresh ether from time to time will sufficiently counteract this refrigeration.

The quantity we have generally found necessary has been about two ounces; yet, as already stated, we are not to be guided by the quantity of ether consumed, but by its effects on the patient. After careful inspection of two hundred cases of both sexes, of all ages, in a great variety of conditions of health and disease, etherized through a sponge without reference to quantity, we have seen no immediate or consequent symptoms, which would lead us to embarrass the patient and the surgeon with a complex apparatus.

The time required is ordinarily from two to five minutes; but this may be prolonged in accordance with the length of the operation, and the difficulty of accomplishing etherization. When this exceeds ten minutes, it is well to raise the sponge frequently, in order to ad-

mit a supply of pure atmospheric air. Dr. J. M. Warren noticed in obstetric cases, that the short panting inspirations natural to the latter stages produced a rapid etherization.

In important operations there is an advantage in preliminary trials, to test the susceptibility of the patient, and instruct him in the manner of the application.

The existence of etherization is usually recognised by the closure of the eyelids, if they had been previously open, by the non-respondence to questions, and by muscular relaxation. The pulse and respiration should be carefully observed, that, when they fail, the process may be discontinued, and the face of the patient sponged with cold water. Should this not be followed by a revival of the respiration and circulation, according to the advice of Dr. Jackson, oxygen gas may be thrown into the lungs. The stimulus of ammonia applied to the nostrils and throat, with frictions and hot applications over the body and extremities, may also be employed.

Another remedy proposed for the state of insensibility is opium, introduced if possible into the stomach, and if not, into the rectum. In the latter case it should be used with the same quantity of water, and in rather a smaller dose than in the former; as dangerous narcotism, when least expected, sometimes follows injections into the rectum. I have known a gentleman dangerously narcotized by an injection of three drachms of the tincture of opium, used in divided doses in the space of three hours.

Children and infants may be safely etherized with proper precautions: the earliest period in my knowledge

has been within two or three months from birth. In very young infants, the state of the pulse, respiration, and of the senses, should be carefully watched.

The administration to these young subjects, while it should be conducted with great attention, must be made in a decided manner. For when the sponge is applied to the nostril, the child attempts to retreat; but by continuing its application a state of tranquillity soon follows, and a satisfactory etherization is accomplished.

So far as my experience has extended, infants are not more speedily affected than adults, at least not more so in proportion to their tender age; but, as I have always proceeded with great caution in these young patients, I may have been deceived on this point.

For reasons already mentioned, the injection of liquid ether into the rectum must be attended with great uncertainty; and the introduction of vaporized ether into the intestines, as it would operate on an absorbent surface less extended and less active than that of the lungs, could not be employed in ordinary cases with the same advantages as inhalation. There are, however, some conditions, in which it might be proper to throw into the rectum the ethereal vapor, as, for example; first, when this could not be introduced into the lungs; second, in cases when the inhalation had failed; third, when the intestines are the seat of a disease, which the vapor of ether might relieve.

The injection of ethereal vapor into the rectum may be accomplished in the same manner as has been practised for its injection into the Eustachian tube in cases of nervous deafness; namely, by a glass tube having a

perforated bulb at one end, into which the ether is to be poured, and the aperture stopped. The other end of the tube is to be connected with a caoutchouc tube passed into the rectum. By immersion of the bulb in warm water, the vaporised ether will be forced into the intestine.

The subject of medicated ethereal inhalation is one of great importance. I have made some trials of this mode of introducing into the system articles of the Materia Medica with much satisfaction, but they are not as yet sufficiently numerous to justify me in recommending the practice.

VII.

Objections have been made to the use of ether in various disorders of the lungs. We have already mentioned instances of pulmonary affection, in which it was used with safety and advantage. When a patient has peculiar irritability of the lungs, it might be wise to avoid its use, unless it were imperiously called for. In common cases of tuberculous affections, whether in a crude or softened state, it is scarcely credible, that any permanent inconvenience could arise.

In children and in infants, although the value of ether is great, in preventing suffering and facilitating indispensable operations, it should always be employed with great care, as previously mentioned, on account of the comparative difficulty of controlling its influence in the tender and excitable age. Ether has been found beneficial in the chronic cough of children, and is likely to be advantageous in hooping-cough, when the inflammatory stage has passed.

In acute pulmonary affections, in individuals predisposed to cerebral excitements and congestions, and in

maniacs generally, the inhalation of ether should not be resorted to till we have had more experience. An instance of its use, however, in a deranged person came within our knowledge.

Dr. Bell, of the McLean Asylum, wished to have an operation for epulis on a lady under his care; and as he thought there would be no objection, she was etherized. She was not very readily, nor powerfully affected. The tumour was cut from the gum, then the socket from which it sprang was included between three incisions of the bone-cutters, two vertical joined by a third horizontal. Some movements were made during the excision, but she afterwards said there was no suffering. No unusual mental disturbance followed, and in three days she was discharged.

Every day is pregnant with new facts relating to this subject, and we have among others some of great importance bearing on the effect of etherization in cerebral diseases. The supposed dangers of etherization in these affections have been proved by observation to be wholly imaginary in some cases where they had seemed to be greatest.

In the course of the present year, a French physician in Algiers ventured to employ etherization in cerebro-spinal meningitis. An epidemic of this character broke out in the French army of Algiers, from the effects of severe horse-exercise under exposure to the burning meridian sun of Africa. Bleeding, purging, cold applications, and every other remedy suggested by the imagination, were employed to mitigate this disease, which, notwithstanding, often proved fatal in twenty-four hours.

Dr. Besseron, physician of the Military Hospital of Mustapha in Algiers (influenced perhaps by the opinion of the Italian physicians, that the effect of ether is hypo-sthenic or sedative), ventured with many precautions to use etherization in this cerebral epidemic. He never carried it to the period of muscular excitation, employing not more than twenty-five inhalations at one application, and repeating it a number of times in twenty-four hours. After a few inhalations the patients experienced relief from the intense pain in the head and back, and at the close were quite free from pain. Out of twelve patients, eight were essentially relieved: two of them relapsed from adventitious circumstances, but six finally recovered their health — a result extremely remarkable compared with that from other modes of treatment.

Monsieur Besseron does not hesitate to advise the trial of etherization in the meningitis of children.

In delirum tremens it might be expected the practice would not be applicable; but Dr. Stedman has used it in the Houses of Industry and Correction at South Boston with good effect, and we have heard of other practioners who have employed it advantageously in this affection. There may be other morbid conditions, in which experience will show that etherization is improper.

In old persons the deficiency of reactive power, and consequent danger of extinguishing the vital principle, might excite apprehensions, although experience has not shown any ground for them hitherto.

Cutting operations on the mouth and throat should not, I formerly thought, be performed with ether. But

a greater experience has led to the conclusion, that generally it may be used in these cases with safety and advantage. In excision of the tonsils particularly, the operation is so short, and the bleeding so slight, that there does not seem to be any objection, when the amygdalotome is employed.

VIII.

In the earlier part of these remarks, the circumstances attending the first use of ether in surgical operations have been sufficiently detailed, and their repetition here will be unnecessary. But there are some facts, relating to the previous history of ether, which we ought not to pass over.

The medical public are by this time abundantly aware, that ethereal inhalation was proposed by Drs. Beddoes, Pearson, and Thornton, for the cure of some diseases of the lungs. Being in London about the period of their publications, I had an opportunity of becoming acquainted with the discussions which then took place on this subject. Its claims were subsequently advocated by Nysten and others.

Sir Humphrey Davy himself successfully employed the inhalation of nitrous oxyde for the relief of pain. In this country, Dr. Horace Wells, of Connecticut, made many trials of this gas in 1844. In the autumn of that year he came to Boston, and, in company with Dr. Morton, visited me at the Medical College, for the pur-

pose of requesting that the medical class should have an opportunity of hearing some remarks on the use of the nitrous oxyde for the prevention of pain. These remarks were actually made, and at a subsequent day a trial of the gas took place. But, as I was very much occupied at the time, these occurrences made so little impression on my mind, that when, in the latter part of 1846, we were assailed in reference to Dr. Morton's first experiments, for a too great facility in adopting novelties, and the facts above mentioned were brought to corroborate the charge, I was for some time not able to understand the grounds of the attack. Dr. Wells, however, in the summer of 1847, mentioned to me circumstances which recalled to my mind his visit; and his statement was afterwards confirmed by that of Dr. Morton. Such are the facts within my knowledge of Dr. Wells's efforts to discover a mode of preventing or alleviating pain in surgical operations. It appears that he did actually prosecute his trials in Connecticut, and elsewhere, to such an extent that, when the matter was investigated by the legislature of the State in the winter of 1847, his labors were thought worthy of honorable notice.

Dr. Marcy, of New York, appears to have had communications with Dr. Wells on the inhalation of ether and of nitrous oxyde; the result of which was, that he advised Dr. Wells to suspend the use of ether, and continue his trials with the nitrous oxyde. Whether these gentlemen had a knowledge of the proposal of Sir Humphrey Davy we are not able to say.

Monsieur Ducos, in Paris, performed some remarka-

ble experiments with ether on animals early in the last year, an account of which is given in the Paris Medical Gazette, of March, 1846. In these experiments were exhibited most of the phenomena which have since been witnessed in the human body. The same ingenious physiologist has recently succeeded in producing a state of insensibility to pain in animals by the use of electro-magnetism.

This discovery certainly merits a notice from the American legislature, since it may take rank perhaps of all the great improvements which adorn the present age of surgery. The establishment of union by the first intention, the safe ligature of the great arteries, the substitution of lithotrity for lithotomy, the rejection of pernicious ointments and plasters in the management of wounds, the constitutional treatment of local diseases, and the free external use of cold water, mark the present as a golden period of surgical science.

The introduction of ether enabling us to perform operations, and apply remedies without pain, crowns all these improvements. What remuneration can be too great for such a discovery!

Should the Congress of the United States follow the generous policy of the British Parliament in similar cases, they would naturally institute an investigation into the facts connected with this discovery, and bestow a proper reward on whomsoever was found to merit it; at the same time annulling the exclusive patent.

While we would pay a willing and liberal tribute to the individual who has been made the instrument of this discovery, we should look higher for its author,

and elevate our fervent attributions of praise and thanksgiving to Him who has been pleased, from the rich treasures of His goodness, to confer so wonderful a gift on our generation!

APPENDIX.

A.

The term ether, æther, is derived from the Greek word *αἴθειν*, to consume; signifying the element of fire situated in the highest region of heaven beyond the air. The date of the discovery of ether is uncertain; for there are passages in the writings of some of the ancients which may be interpreted to refer to it, but not so explicitly as to render certain a knowledge of it by them. The oldest of these references is by Raymond Lully, of the thirteenth century; the second by Basil Valentine, of the fifteenth century. In the year 1540, Valerius Cordus, of Nuremberg, describes, under the name of *oleum vitrioli dulce*, an article approximating to very impure sulphuric ether; the description of which is transcribed by Conrad Gessner, in 1552.

The earliest period at which this fluid is distinctly mentioned by the name of ether, within our knowledge, is in an article by Mr. Godfrey, in the Transactions of

the Royal Society of London for 1730, art. 8, p. 283, in which certain experiments with it are detailed, and its refrigerating and inflammable nature spoken of. Although the writer appears to consider the discovery as originating from a German chemist, Frobenius, an assumed name it is supposed by Macquer; yet he speaks of some experiments with ether in the laboratory of his master, Boyle, at a previous date, and, in corroboration of the accuracy of his statement, refers to the works of Sir Isaac Newton, by whom it is styled Spiritus vini æthereus.

This appears to be the first authentic account of ether and its properties. That sulphuric ether was the kind employed, is evident from its mode of preparation, "equal parts, by weight, of vitriolic oil and spirits of wine."

From the year 1730 the attention of chemists was much directed to ether. It was manufactured with difficulty, and in small quantities, until great facilities were introduced by *Hellot*, after whose time it has been abundantly made. At a subsequent period the labor of Baumé, embracing as it does not only a chemical examination of the properties of ether, but also of the various other products resulting from the distillation of alcohol and sulphuric acid, was a great contribution to the chemical science of the time.

From the analysis of Saussure, the composition of pure ether is found to be as follows: Carbon, 64.96; hydrogen, 13.47; oxygen, 21.57.

The ethers are limpid, diaphanous fluids, of a highly volatile nature, and strong penetrating odour. They

are of different kinds, produced by the action of alcohol with different acids; thus we have, besides the sulphuric, the acetic, nitric, muriatic, and chlorine ethers. A variety of the last of these, discovered by Mr. Guthrie, of this country, in consequence of an effort to manufacture the diluted chlorine ether of the Dutch chemists, on the recommendation of Professor Silliman, is esteemed as a mild, diffusible stimulant, constituting so pleasant a drink when diluted with water, as to have been used for purposes of intoxication. The Spirits of Nitrous Ether, Hoffman's Anodyne Liquor, and Clutton's Febrifuge, are well-known preparations.

The effects of nitric ether are more active than those of sulphuric. Both of them have been used internally for many years: their stimulating and very diffusible properties have, however, prevented their extensive employment, excepting in a modified state. They have also been used externally as refrigerants by evaporation. The late Dr. Thatcher, of Plymouth, in Massachusetts, recommended the use of sulphuric ether in this way for the reduction of strangulated hernia.

Mr. Robert Ferguson, an enterprising chemist and apothecary of this city, has furnished me with the following formula for the preparation of sulphuric ether, as pursued at the Norfolk Laboratory, belonging to Messrs. Everett & Blake, and for some years under his charge:

"Into a lead retort, introduce by small portions at a time, through the safety-tube (after the apparatus is luted together), ninety pounds of sulphuric acid, and

ninety pounds of strong alcohol. Raise the heat until it boils gently, and continue it so till sulphurous vapors appear at the orifice of the pipe proceeding from the receiver. The operation will require about one day. A second forty-five pounds of alcohol are added to the mass in the retort, and the distillation continued as before. On the third day the same quantity of alcohol is added, and the distillation continued. When cold, remove the residuum from the retort, and dilute with water, and preserve it for making the sulphate of potassa. Place the distilled liquor in closely stopped demijohns, and add thereto a small quantity of potassa, in order to remove the sulphurous acid with which it is contaminated; agitate occasionally for two or three days, decant, and return it into the retort, which ought previously to be cleaned, as also the receiver and condenser. Let the retort be carefully luted, and apply a moderate heat, not sufficient to produce boiling.

"The sulphuric ether in general use among druggists, contains more or less alcohol and water. It may be obtained pure by adding to it dry sub-carbonate of potassa, as long as it is wetted by the liquor; decanting it, and adding dry muriate of lime. The carbonate in the first instance separates the water, and the alcohol is separated by the muriate of lime. In this manner I have obtained it of the specific gravity of .630 at 60° F. It is not in this state, however, perfectly pure, but contains a quantity of the salts, from which it may be freed by distillation, though not without increasing the specific gravity."

Ether thus prepared is proper for inhalation, and

we have been in the habit of employing it for this purpose.

The mode of preparation recommended by Dr. Jackson, is as follows. The strongest and purest rectified sulphuric ether, which can usually be obtained from the druggists, is agitated with water, for the purpose of removing all acid. It is then freed from the water it may have taken up, by the chloride of calcium. Its specific gravity is thus rendered about .725.

B.

The opinion expressed in the text as to the comparative period of etherization of the cerebral lobes and the encephalic ganglia, differs from that of the able physiologist, Mons. Longet. Which of the two best explains the phenomena must be decided by a careful observation of facts. In justice to Mons. Longet, it seems proper to present his views on this subject. In his opinion there are a certain class of cases, where, during the operation, the patient evinces the customary signs of pain, and appears to the by-standers to be undergoing the usual amount of suffering; and yet, when the operation is terminated, he declares that he has suffered no pain. It must be recognized that in these cases the etherization has been imperfect, extending only to the cerebral lobes without reaching the cephalic ganglia. In such cases the pain must be allowed to have been *felt*, but not *perceived* — the

cries, groans, etc., were reflex actions from the centre where these sensations are received. The *perception* of these sensations did not take place, because the organ of perception, the cerebral lobes, was under the influence of ether.

The recognition of this fact is of importance in a practical point of view. For if, as we suppose, there be reason to believe that the actual danger resulting from an operation is diminished by its being done with the patient under the complete influence of ether, inasmuch as the nervous centres being dormant, the shock must necessarily be diminished, we must recognize that in this class of cases the shock to the nervous centres may be felt in its full force;—in fine, that the *sensation* of pain may be as injurious as its *perception*, and is equally to be avoided.

Mons. Longet, it appears, maintains the opinion, that in these cases of agitation and crying out the cerebral lobes are first etherized, while the annular protuberance is not; therefore sensitiveness residing, as he thinks, in the latter is not abolished, but the cerebral lobes being in an etherized state take no cognizance of the painful sensations.

Now, in these cases of oblivion of pain, the cerebral lobes, the seat of intellect, being etherized, the intellectual functions should be suspended, according to him, which we know is not the fact in a number of instances. For in such cases, when there are signs of existing sensitiveness, there are also signs of intellectual action; the patient answers questions proposed to him, he also sees and hears.

C.

This case not having terminated at the time the first part of the description was in type, the remainder is inserted here. The stone was about half an inch long, the fourth of an inch thick, and in form of a flattened oval. It was sawn by Dr. J. B. S. Jackson. The exterior layer consisted of a whitish deposit, the sixteenth of an inch in thickness, and composed apparently of triple phosphate. The layers within this were of a brownish color, like that of the phosphate of lime, and were about half a line in thickness. In the midst of these was a harder substance, about a line in diameter, which appeared to be siliceous; its outline could not be exactly distinguished from the surrounding layer of brown deposit. The analysis was committed to Dr. Martin Gay, but was not accomplished in time to enable us to say, whether the constituents were certainly the substances above indicated.

The retrograde passage of the apparent nucleus into the bladder may excite surprise, unless we take into consideration the inverted action of the urethra, by which bodies received into it are so often conveyed from without into this organ, where they serve as the nuclei of stones. The introduction of this nucleus may receive an additional explanation from the fact, that the gravel-stone removed by the mother prevented the passage of urine forced into the urethra by the strong contractions of the bladder, and this not escaping, was

driven back by the contractions of the urethra, carrying along the inner stone which formed the nucleus.

The protracted etherization left behind it no distinguishable symptoms. The boy experienced a moderate invasion of fever, without any abdominal disturbance, or any remarkable local inflammation. The urine flowed through the penis on the second day, but the swelling about the urethra prevented its re-appearance for a week. Since then, it has gradually resumed its natural passage, and now passes wholly by the urethra, though the external wound is not entirely healed. With this exception, the boy is quite well, and on his feet.

The bi-lateral operation employed in this instance, is, in my opinion, the safest and easiest, as I have stated in the American Journal of the Medical Sciences, and which, I am glad to find, has found favor with some able surgeons of the south and west. In the cases where I have employed it, the external wound has the disadvantage of healing more slowly than after the lateral operation.

CHLOROFORM.

In the preceding part of these pages, we mentioned, among the other ethers, a preparation called chloric or chlorine ether. This, in its ordinary state, we used in the early stage of the practice of etherization, without any well marked effect. We have just learnt, that Professor Simpson, of Edinburgh, and Mr. Bell, of London, have employed this liquor in a concentrated state, as a substitute for sulphuric ether, in producing etherization; and, as stated by the former gentleman, with more agreeable results. But the latter, although the first to use it, after making a number of trials, seems to have abandoned it, on account of the comparative expensiveness.

Professor Simpson says, that it acts in smaller quantity, more speedily, with less irritation of the lungs, more pleasant consequences, and that it has a fragrant smell. He thinks it will prove to be an excellent substitute for sulphuric ether. On employing this article, we have verified the properties ascribed to it by him, so far as to justify the conclusion, that it may

be often used advantageously instead of sulphuric ether. But we are not prepared to support its pretensions to become a substitute for the latter in general practice. We shall, however, proceed to employ it, until a fair trial has been made of its properties, and be governed in its use by the result.

There is one great advantage in this substance, that, being required in small quantity, it may be easily transported; and there is one great objection, that its expensiveness must at present prevent its general use.

We have employed it on a rag, as recommended by Professor Simpson, and also by a sponge, which has proved more satisfactory. But, considering its high cost, it seems better, contrary to the mode employed in administering sulphuric ether, to apply it by an inhaling apparatus, as by this mode it would not come in contact with the skin, and no unnecessary quantity would be used.

Chloric Ether was prepared by Mr. Guthrie, in this country, in the year 1831. His mode, as stated in Silliman's American Journal of the Arts and Sciences, vol. xxi. was this:

"Into a clean copper still, put three pounds of chloride of lime, and two gallons of well-flavored alcohol, of specific gravity .844, and distil. Watch the process, and when the product ceases to come over highly sweet and aromatic, remove, and cork it up closely in glass vessels. The remainder of the spirit should be distilled off for a new operation."

This liquid was subsequently examined by Liebig and Dumas. By the former, Liebig, it has been styled

the *Perchloride of Formyle*, and the following method of preparing it given :

"One part of hydrate of lime is suspended in twenty-four parts of water, and a current of chlorine gas is sent through the mixture until the greater part of the lime is dissolved, and a little milk of lime is added, to make the mixture alkaline. When the solution of chloride of lime has become clear by repose, one-twenty-fourth of its volume of alcohol is added; and, after being left to itself for twenty-four hours, the liquid is distilled by a gentle heat in a capacious retort. The product has an ethereal odour, and contains *perchloride of formyle*, mixed with alcohol. On shaking it, the perchloride separates as a dense liquid, and may be obtained perfectly pure by digesting it on chloride of calcium, and distilling it again with concentrated sulphuric acid."

By the latter, Dumas, on account of the relation of its composition to formic acid, it has been denominated *Chloroform*, and the following simple method for procuring it suggested :

"Four pounds of chloride of lime are added to twelve pounds of water, and twelve fluid ounces of rectified spirit. This mixture is distilled as long as a dense liquid, which sinks in the water which it covers over, is produced."

We are informed by Professor Simpson, that it can also be procured, "by making milk of lime, or an aqueous solution of caustic alkali, act upon chloral; by distilling alcohol, pyroxylic spirit, or acetone, with

rational and potent means, have been exemplified in such a lucid, impressive, and eloquent manner, that the theory and inductive practice cannot fail of being universally accredited and confidently adopted. Dr. Warren has rendered invaluable services to his country; and his admirable compendium should be introduced into every family, academy and college, as the sanative manual of parents and instructors, for their guidance in conducting the physical education of their children and pupils, which is too generally utterly neglected.

From the Daily Advertiser.

This little work deserves a more general notice than we have yet seen, for its peculiarly useful character, as well as for its delicacy of expression, and important teachings. Unlike most works upon health, it is neither voluminous nor expensive. The sound principles and directions it contains are condensed in so interesting a manner as to render it an invaluable companion: while the clearness of typography and its beautiful appearance will constitute an ornament to any centre table. Our young men would do well to take heed to its doctrines in respect to diet, the use of stimulants and tobacco. * * In short, it is one of those rare works which now and then appear, that ought to be in possession of every family throughout the land.

From the Journal of Health.

It embodies the experience of a long life in the practice of medicine and surgery. Nothing could have been more needed than such a book; and the subjects on which it speaks are just what every man, woman and child should understand. The first one named is physical education, upon which the community need "line upon line, and precept upon precept." Then follow the subjects of digestion, exercise, sleeping, use of water, friction, tobacco, and the conclusion. We rejoice to find these subjects discussed here with a degree of clearness, pathos, and precision seldom found, and backed by an experience perhaps unequalled by any man in our country, in investigating the human body, prescribing for its diseases, and administering to its accidents.

From the Boston Atlas.

All over the country this treatise has been hailed with marked pleasure, and seems to be doing an immense amount of

good. The American Journal of the Medical Sciences, published in Philadelphia, speaks of it in the highest terms; and observes, with reference to its success, "that one of the most important missions of a true and enlightened physician is to point out to mankind the way to avoid the causes which engender disease, and to show them the necessity of giving heed to the warnings of mischief going on within themselves, ere complete derangement takes place, and to endeavor to convince them that the various parts and organs of their wonderfully contrived body are generally fixed laws, which cannot be departed from, without sooner or later causing suffering and disease. Such is the aim of Dr. Warren's book on the preservation of health." The author has benefitted mankind by his judicious remarks, the soundness of whose doctrine is universally admitted.

From the Evening Transcript.

The importance of a sound constitution, and of good health, is acknowledged by every one in the moment of sickness; but when engaged in the active duties of life, we are too prone to neglect the proper measures to keep that soundness of body upon which a sound mind depends. A little work with the above title has recently appeared, from the pen of Dr. John C. Warren; and it must be gratifying to every philanthropic person to find one, of his experience pointing out to people in general the means of health. The work is invaluable — plain and concise in style; clear and firm in its teachings, it should be in possession of every family in the country.

From Edward Everett, President of Harvard University.

Dr. J. C. Warren. My dear sir; — Allow me to return you my thanks for the copy you were so good as to give me of your "Essay on Physical Education, and the Preservation of Health." I have read it more than once with great pleasure. It appears to me to contain information of the highest importance on the structure and functions of the human frame and of the proper course to be pursued as to exercise and food, with a view to the prevention of those diseases, by which life is shortened in many cases, and in many more its enjoyment and usefulness are greatly impaired.

Hoping that this little publication will be extensively read by the young of both sexes, who stand most in need of its lessons, I remain, my dear sir, with the highest regard, faithfully yours,

EDWARD EVERETT.

From Professor Mussey, of Cincinnati, Ohio.

My dear sir;—I am very glad to see your Essay on Health put in a form that will admit of its extensive circulation. The preservation of health, strange as the fact may seem, is one of the last to be *studied*, while every one gives a ready assent to the common place remark, that "health is a great blessing, and without it there can be but little enjoyment in this world." If all classes of society could be induced to attend in earnest to this subject,—to avail themselves of all the light within their reach, and practically to follow out well established hygienic principles, mankind would be released from a large proportion of their physical suffering.

That your Essay may be generally read, and its valuable maxims put in practice, is the sincere desire of your friend,

R. D. MUSSEY.

To Dr. J. C. Warren.

From Professor Dickson, of Charleston, South Carolina.

John C. Warren, M. D., My dear sir;—Your very pretty little volume on Hygiene has just come safely to hand—and the receipt of it is productive of very great pleasure to me. First, from its intrinsic value as a code of laws whose importance is confirmed by the experience and observation of one of the oldest, wisest, and most eminent of our profession—and secondly, as a mark of courteous remembrance from one whom we all delight to honor.

Receive my sincere acknowledgments, and believe me to be, with the highest esteem and respect, your obedient servant,

SAMUEL HENRY DICKSON.

From Hon. Judge White, of Salem, Mass.

John C. Warren, M. D.—My dear sir;—I thank you most heartily for your beautiful little volume on the "Preservation of Health"—which I have read with great pleasure and satisfaction. It appears to me to be as good as it could be both in point of matter and style—condensing as it does the soundest principles and directions in so interesting a manner and with such delicacy of expression as must make it a welcome parlor companion in refined society, while it is a most valuable and useful one every where.

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With the highest regard, your obliged friend,

D. A. WHITE.